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BACKGROUND

In the PICMG arena, CompactPCI has been a key backplane-based technology. It grew rapidly from its introduction in 1998 until the Telecom crash. With higher pin counts, Eurocard form factor, and hot swap capability, it has been a great open specification for Communications systems. With 33 Mhz processors limited to 8-slots over cPCI backplanes (without bridging) and 66 Mhz limited to 5-slots, the PICMG 2.0 specifications started to run into its performance limitations. The PICMG 2.16 and PICMG 2.17 specifications, running Ethernet and StarFabric fabrics respectively, have boosted the performance and reliability and will extend CompactPCI's life. But, PICMG realized its market needs even higher bandwidth and saw the Telecom Central Office as a key segment. Therefore, AdvancedTCA was introduced in the Fall of 2002. Switch cards from various vendors have been hitting the market since late 2003 and the technology appears to be taking off.

AdvancedTCA is the major initiative from PICMG, with over 125 members participating. The 8U x 280mm cards and 1.2" pitch allow large server blades with a wealth of components to be used. The technology utilizes primarily Dual Star (two hubs slots with direct links to each of the node slots) and Mesh switched fabric topologies (each slot acts as a hub slot, with direct links to every other slots, vastly increasing the bandwidth). The architecture will be able to handle interfaces up to 40Gpbs (for Terabit backplane bandwidth), High Availability (99.999% uptime), and Quality of Service issues demanded by the telecom central office. Geared towards CO applications, the backplane allows for 48VDC input from an external source to be distributed to the individual slot cards. The PICMG 3.0 core specification for AdvancedTCA has been ratified since late 2002. The sub-specifications for Ethernet (PICMG 3.1), Infiniband (PICMG 3.2), StarFabric (PICMG 3.3), and PCI Express (PICMG 3.4) have also been ratified. A new sub-specification for RapidIO over ATCA has been announced - PICMG 3.5. PICMG sponsors hope that base ATCA will become an all-encompassing architecture for network architectures from the Data Center to the Core to the Access Edge.

ATCA PERFORMANCE

Among the main goals for ATCA were to offer a viable solution for a host of performance limiting drawbacks of other architectures. For example, the insufficient board space to package the requisite functionality, narrow board spacing (pitch), limited backplane throughput, demanding levels of signal integrity and EMC, inadequate system management modules (both h/w and s/w) and lack of scalability in capacity, reliability and performance. The advent of ATCA offers compelling reasons to select it as the platform of choice carrier-grade operating systems. ATCA boasts the following:

- High speeds scalable to 2.5Tb/sec.
- High Availability RAS (Reliability, Availability and Serviceability) functionality by virtue of Redundancy, Failover, Fault prediction
 and prevention
- Open standards
- Interoperable third party products contributing to a dynamic ecosystem
- · Robust system management features
- Scalable and cost effective

ATCA FORM FACTOR AND ZONES



The ATCA backplane is broken up into zones. Zone 1 contains the power connector as well as the redundant IPMB's. Zone 2 is made up of the signal connectors carrying the base interface, clocks, update channel interface and the fabric interface. The base interface uses an Ethernet Dual Star topo ogy. Horizontally the connector columns have 5 differential pairs and vertically there are 10 rows. The ZD connector is specifically designed for high speed differential signaling, and is capable of speeds up to 5 Gbps. Zone 3 is for Rear Transition Modules.



ATCA TOPOLOGIES

AdvancedTCA specification allows a variety of architectural implementations. The topologies of the specification are Dual Star, Dual Dual Star, and Mesh (including Replicated Mesh). All of these configurations can go up to 14 slots (in a 19" rack). However, Replicated Mesh is limited to 8 slots. An ingenious channel mapping allows a standard ATCA switch card to support any configuration. For instance, a Dual Star (redundant hub slots running the fabric) implementation could be implemented with cards at either end of the subrack, adjacent in slots one and two or in the middle of the backplane.

The topology of the ATCA backplane can greatly affect the overall system cost as the cards, backplane, etc, will be affected. Focusing on the bac plane, a Mesh topology can demand significantly more layers than a Dual Star topology. With more point-to-point links, more layers need to be added to achieve the signal routing, which increase the cost of the backplane.

Dual Star, Dual-Dual Star, and Mesh configurations are available. See diagrams showing how nodes are interconnected in each topology.



Dual Star is a common topology with two fabrics slots, offering redundancy and helping achieve high availability. A Dual-Dual Star configuration has two sets of two fabric slots and offers multi-segment and multi-fabric options.

Dual Star topologies require two dedicated system slots (Fabric Slots) for the central switch Fabric Boards to reside. Each switch Fabric Board supports a Channel connection to all Node Boards in the system. Thus, each Node Board card has two Channels, one for each switch fabric. There is also a Channel connection between each Fabric Board. The number of Node Boards supported within a particular backplane implementation may vary up to a maximum of 14 total Node Boards/ Slots (in a 19" rack) which are connected to two dedicated switch Fabric Boards/Slots. In a PICMG 3.0 backplane the Base Interface is always routed as a Dual Star with Fabric Slots located in Logical Slots 1 & 2; the Fabric Interface minimum configuration is a Dual Star with Fabric Slots located in Logical Slots 1 & 2.

DUAL STAR BACKPLANE FABRIC POSITION

Dual Star Backplanes and Frames require installation of Fabric Boards to provide connectivity between Node Boards. PICMG 3.0 requires Fabric Boards to be installed into the lowest numbered Logical Slots (e.g. Slots 1 & 2). PICMG 3.0 systems may, however, have Fabric Slots/Boards located in any physical slot position. To facilitate system configuration, the Chassis FRU ROM is required to provide a mapping of Logical Slot positions to Physical slot positions.

Mesh

In a Mesh topology (where each node acts as a fabric slot, interconnected to the other with point-to-point links), the data rates and protocols are not dependent of other data transfers in other slots. So, it is highly scalable, forgoing latency and determinism problems. Mesh can be used in any slot size. However more slots used, the more difficulty in routing the numerous links. A 14-slot Mesh version would have very high layer counts and the expense of the backplane will rise. Therefore, Mesh configuration is, the attractive for smaller systems.

Mesh configurations do not utilize a central switch fabric; all system slots can be used for data forwarding or processing resources, which makes maximum use of the physical system capacity Another advantage of a full mesh is reduced start-up cost for partially equipped systems. Since the fabric capacity grows as you add system boards, there is no need to invest in expensive central fabrics that could have a great deal of unused capacity in lightly loaded systems, improving the economics of scaling. Further, all slots are identical, which eases installation and serviceability of the system. Mesh backplanes can support Star-based system configurations since Fabric Boards may be installed into logical slots 1 & 2. and Node Boards may be installed into all remaining slots just as done in a Dual Star Backplane.

INSPECTING YOUR BACKPLANE

Take great care when handling the backplane. Always use proper ESD handling procedures. Improper handling could cause damage to the connector pins. Always handle the backplane from the edges, never the connectors.

The first item that must be done before starting to utilize your backplane is to perform a thorough inspection. During the course of handling, shipping and assembly, pins, shrouds, mounting screws and other items could become damaged and/or loose. Operating a damaged backplane could cause serious damage to the backplane and/or devices that interface to it.

Take a few minutes to visually inspect that all of the connector pins are straight, screws are tight, etc. Repair any bent pins, shrouds, loose screws, etc. before proceeding. If the damage to the backplane is deemed too extensive, please call Elma Bustronic for assistance on how to proceed.

INSTALLING YOUR BACKPLANE IN A SUB-RACK

Elma Bustronic ATCA backplanes use M3 Phillips head screws along the rows of mounting holes located at the top and bottom end of each slot. Install one screw in each hole and tighten securely. Do not install a screw in the mounting hole marked with a digital ground if a connection between chassis (safety) ground and digital (circuit) ground is not desired. The mounting hole that connects to digital ground is marked as *Shelf GND to Logical GND*. See Figure 1 below.



ZONE 2 CONNECTIONS

The Figure below illustrates the arrangement of signals on the ZD connector. The view is looking directly into the connector on the backplane.



2-SLOT MESH PINOUTS

5U, 2-Slot, Mesh ATCA Backplane Part# 109ATCA502

			n (* 17		
	5VOUT			I ² C/FTF	P/PEM
	1	5VOUT		1	1 ² C_3_INT
	2	SCL_A		2	1 ² C_3_SCL
	3	SDA_A		3	1 ² C_3_SDA
	4	GND		4	FTP_0
	5	GND		5	FTP_2
	6	SDA_B		6	PEM0
	7	SCL_B		7	PEM1
	8	5VOUT		8	FTP_3
	A.58	Constanting of		9	FTP_1
				10	1 ² C_2_SDA
1			1	11	I ² C_2_SCL
	SHMC			12	1 ² C 2 INT
	1 2 3	E1RP E1RN E1TP			nnects to 1SHMM1 nnects to 2SHMM1
	0	L 1 1 1			

E1RP
E1RN
E1TP
E2RP
E2RN
E1TN
E2TP
E2TN

I ² C/FTF	P/PEM
1	I ² C_3_INT
2	I ² C_3_SCL
3	I ² C_3_SDA
4	FTP_0
5	FTP_2
6	PEM0
7	PEM1
8	FTP_3
9	FTP_1
10	I ² C_2_SDA
11	I ² C_2_SCL
12	I ² C_2_INT
Port E1 co	nnects to 1SHMM1
Port E2 co	nnects to 2SHMM1

RRTN_B -RI	NG_B RRTN_A	A -RING_A	
4 MT2_RING	3 MT2_RING	2 MT2_TIP	1 MT2_TIP
1			

TEOUT	/FILTER/PWM/TACH/SENSE
1	FTFOUT_2
2	FTFOUT_0
3	FILTER0
4	PWM_0
5	PWM_2
6	TACH_0
7	TACH_2
8	TACH_4
9	TACH_6
10	NO CONNECT
11	-48VB3_SENSE
12	NO CONNECT
13	-48VA3_SENSE
14	NO CONNECT
15	-48VB4_SENSE
16	NO CONNECT
17	-48VA4_SENSE
18	-48VA4_RTN_SENSE
19	NO CONNECT
20	-48VB4_RTN_SENSE
21	NO CONNECT
22	-48VA3_RTN_SENSE
23	NO CONNECT
24	-48VB3_RTN_SENSE
25	NO CONNECT
26	TACH_7
27	TACH_5
28	TACH_3
29	TACH_1
	PWM_3
31	
	FILTER1
	FTFOUT_1
34	FTFOUT_3

2-SLOT MESH POWER DISTRIBUTION

Physical Slot	1	2
Logical Slot	1	2
Source	A/B	A/B

HARDWARE ADDRESS

5U, 2-Slot, Mesh ATCA Backplane Part# 109ATCA502

Physical Slot		2
Logical Slot		2
Default	0	CND
HA0	Open	GND
HA1	GND	Open
HA2	GND	GND
HA3	GND	GND
HA4	GND	GND
HA5	GND	GND
HA6	Open	Open
HA7	Open	Open

5-SLOT MESH PINOUTS

5U, 5-Slot, Mesh ATCA Backplane Part# 109ATCA505

UPDATE CHANNELS

5U, 2-Slot, Mesh ATCA Backplane Part# 109ATCA502





5-SLOT MESH POWER DISTRIBUTION

5U, 5-Slot, Mesh ATCA Backplane Part# 109ATCA505

Physical Slot	1	2	3	4	5
Logical slot	1	2	3	4	5
Source	A/B	A/B	A/B	A/B	A/B

HARDWARE ADDRESS

5U, 5-Slot, Mesh ATCA Backplane Part# 109ATCA505

Physical Slot	1	2	3	4	5
Logical slot	1	2	3	4	5
Default					
HA	O OPEN	GND	OPEN	GND	OPEN
HA	GND	OPEN	OPEN	GND	GND
HA	2 GND	GND	GND	OPEN	OPEN
HA	GND	GND	GND	GND	GND
HA	GND	GND	GND	GND	GND
HA	5 GND	GND	GND	GND	GND
HA	OPEN	OPEN	OPEN	OPEN	OPEN
HAT	OPEN	OPEN	GND	OPEN	GND

UPDATE CHANNELS

5U, 5-Slot, Mesh ATCA Backplane Part# 109ATCA505



5-SLOT ROUTING TABLE

Logical/I	Physical Slot#	1	2	3	4	5	_
Connector	Channel						_
P20	Fabric Ch 15	-		(.)		5. • .	h
P20	Fabric Ch 14	.	-	15	÷	•	
P20	Fabric Ch 13		-	1.5			J
P21	Fabric Ch 12	S5-CH9	S5-CH10	S5-CH11	S5-CH12	S4-CH12	h
P21	Fabric Ch 11	S4-CH9	S4-CH10	S4-CH11	S3-CH11	S3-CH12	
P21	Fabric Ch 10	S3-CH9	S3-CH10	S2-CH10	S2-CH11	S2-CH12	
P21	Fabric Ch 9	S2-CH9	S1-CH9	S1-CH10	S1-CH11	S1-CH12	J
P21	Fabric Ch 8	S5-CH5	S5-CH6	S5-CH7	S5-CH8	S4-CH8	h
P22	Fabric Ch 7	S4-CH5	S4-CH6	S4-CH7	S3-CH8	S3-CH8	
P22	Fabric Ch 6	S3-CH5	S3-CH6	S2-CH6	S2-CH7	S2-CH8	1
P22	Fabric Ch 5	S2-CH5	S1-CH5	S1-CH6	S1-CH7	S1-CH8	IJ
P22	Fabric Ch 4	S5-CH1	S5-CH2	S5-CH3	S5-CH4	S4-CH4	ħ
P22	Fabric Ch 3	S4-CH1	S4-CH2	S4-CH3	S3-CH3	S3-CH4	1
P23	Fabric Ch 2	S3-CH1	S3-CH2	S2-CH2	S2-CH3	S2-CH4	1
P23	Fabric Ch 1	S2-CH1	S1-CH1	S1-CH2	S1-CH3	S1-CH4	Ų
P23	Base Ch 1	ShMC	ShMC	S1-CH3	S1-CH4	S1-CH5	
P23	Base Ch 2	S2-CH2	S1-CH2	S2-CH3	S2-CH4	S2-CH5	
P23	Base Ch 3	S3-CH1	S3-CH2	1.5			
P23	Base Ch 4	S4-CH1	S4-CH2	•		220	1
P23	Base Ch 5	S5-CH1	S5-CH2	14			



5-Slot Replicated Mesh Backplane Configuration

Legend: S = Slot #

Ch = Channel #

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6-SLOT MESH POWER DISTRIBUTION

5U, 6-Slot, Mesh ATCA Backplane Part# 109ATCA506

Physical Slot 1	2 3	4 5	6
Logical slot 1	2 3	4 5	6
Source A/B	A/B A/B	A/B A/B	A/B

HARDWARE ADDRESS

5U, 6-Slot, Mesh ATCA Backplane Part# 109ATCA506

Physical Slot	1	2	3	4	5	6
Logical slot	1	2	3	4	5	6
Default			00511			
HA0	OPEN	GND	OPEN	GND	OPEN	GND
HA1	GND	OPEN	OPEN	GND	GND	OPEN
HA2	GND	GND	GND	OPEN	OPEN	OPEN
HA3	GND	GND	GND	GND	GND	GND
HA4	GND	GND	GND	GND	GND	GND
HA5	GND	GND	GND	GND	GND	GND
HA6	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
HA7	OPEN	OPEN	GND	OPEN	GND	GND

UPDATE CHANNELS

5U, 6-Slot, Mesh ATCA Backplane Part# 109ATCA506



6-SLOT MESH PINOUTS

5U, 6-Slot, Mesh ATCA Backplane Part# 109ATCA506



6-SLOT CHANNEL MAPPING

Connector Channel P20 Fabric Ch 15 6-11 6-12 6-13 6-14 6-15 P20 Fabric Ch 14 5-11 5-12 5-13 5-14 4-14 P20 Fabric Ch 13 4-11 4-12 4-13 3-13 3-14 P20 Fabric Ch 13 4-11 4-12 4-13 3-13 3-14 P21 Fabric Ch 12 3-11 3-12 2-12 2-13 2-14 P21 Fabric Ch 11 2-11 1-11 1-12 1-13 1-14 P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 10 6-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9 P21 Fabric Ch 7 3-6 3-7 2-7 2-8 2-9	4 4-15 4 2-15 4 2-15 4 1-15 0 5-10 4-10
P20 Fabric Ch 14 5-11 5-12 5-13 5-14 4-14 P20 Fabric Ch 13 4-11 4-12 4-13 3-13 3-14 P21 Fabric Ch 12 3-11 3-12 2-12 2-13 2-14 P21 Fabric Ch 11 2-11 1-11 1-12 1-13 1-14 P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4 4-15 4 2-15 4 2-15 4 1-15 0 5-10 4-10
P20 Fabric Ch 13 4-11 4-12 4-13 3-13 3-14 P21 Fabric Ch 12 3-11 3-12 2-12 2-13 2-14 P21 Fabric Ch 11 2-11 1-11 1-12 1-13 1-14 P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4 2-15 4 1-15 0 5-10 4-10
P21 Fabric Ch 12 3-11 3-12 2-12 2-13 2-14 P21 Fabric Ch 11 2-11 1-11 1-12 1-13 1-14 P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4 2-15 4 1-15 0 5-10 4-10
P21 Fabric Ch 11 2-11 1-11 1-12 1-13 1-14 P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4 1-15 0 5-10 4-10
P21 Fabric Ch 10 6-6 6-7 6-8 6-9 6-10 P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4-10
P21 Fabric Ch 9 5-6 5-7 5-8 5-9 4-9 P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4-10
P21 Fabric Ch 8 4-6 4-7 4-8 3-8 3-9	4-10
	3-10
P22 Fabric Ch 7 3-6 3-7 2-7 2-8 2-9	
	2-10 ร็ฐ
P22 Fabric Ch 6 2-6 1-6 1-7 1-8 1-9	2-10 1-10 PU BU C W C BU C C C C C C C C C C C C C
P22 Fabric Ch 5 6-1 6-2 6-3 6-4 6-5	5-5
P22 Fabric Ch 4 5-1 5-2 5-3 5-4 4-4	120.035
P22 Fabric Ch 3 4-1 4-2 4-3 3-3 3-4	2-5 1-5
P23 Fabric Ch 2 3-1 3-2 2-2 2-3 2-4	2-5 2-5
P23 Fabric Ch 1 2-1 2-1 1-2 1-3 1-4	1-5
P23 Base Ch 1 ShMC ShMC 1-3 1-4 1-5	1-6
P23 Base Ch 2 2-2 1-2 2-3 2-4 2-5	2-6
P23 Base Ch 3 3-1 3-2	-
P23 Base Ch 4 4-1 4-2	-
P23 Base Ch 5 5-1 5-2	-
P23 Base Ch 6 6-1 6-2	-

Format: Slot - Channel

14-SLOT MESH POWER DISTRIBUTION

5U, 14-Slot, Mesh ATCA Backplane Part# 1900001778

Physical	Slot 1	2 3	4 5	6 7	8 9	10	11 12	13 14
Logical s	lot 1	2 3	4 5	6 7	8 9	10	11 12	13 14
Source	A/B	A/B A/B	A/B A/B	A/B A/B	A/B A/B	A/B	A/B A/B	A/B A/B

14-SLOT MESH UPDATE CHANNELS

5U, 14-Slot, Mesh ATCA Backplane Part# 1900001778

Physical Slot	1 2 3 4 5 6 7 8 9 10 11 12 13 14
Logical Slot	1 2 3 4 5 6 7 8 9 10 11 12 13 14
	UPCH4 UPCH3 UPCH2 UPCH1 UPCH6 UPCH5 UPCH8 UPCH7 UPCH10 UPCH9 UPCH14 UPCH13 UPCH12 UPCH11

14-SLOT MESH ROUTING TABLE

	Logical Slot #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Connect or	Channel #														
P20	14														
P20	13	14-1	14-2	14-3	14-4	14-5	14-6	14-7	14-8	14-9	14-10	14-11	14-12	14-13	13-13
P20	12	13-1	13-2	13-3	13-4	13-5	13-6	13-7	13-8	13-9	13-10	13-11	13-12	12-12	12-13
P21	11	12-1	12-2	12-3	12-4	12-5	12-6	12-7	12-8	12-9	12-10	12-11	11-11	11-12	11-13
P21	10	11-1	11-2	11-3	11-4	11-5	11-6	11-7	11-8	11-9	11-10	10-10	10-11	10-12	10-13
P21	9	10-1	10-2	10-3	10-4	10-5	10-6	10-7	10-8	10-9	9-9	9-10	9-11	9-12	9-13
P21	8	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	8-8	8-9	8-10	8-11	8-12	8-13
P22	7	8-1	8-2	8-3	8-4	8-5	8-6	8-7	7-7	7-8	7-9	7-10	7-11	7-12	7-13
P22	6	7-1	7-2	7-3	7-4	7-5	7-6	6-6	6-7	6-8	6-9	6-10	6-11	6-12	6-13
P22	5	6-1	6-2	6-3	6-4	6-5	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12	5-13
P22	4	5-1	5-2	5-3	5-4	4-4	4-5	4-6	4-7	4-8	4-9	4-10	4-11	4-12	4-13
P22	3	4-1	4-2	4-3	3-3	3-4	3-5	3-6	3-7	3-8	3-9	3-10	3-11	3-12	3-13
P23	2	3-1	3-2	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10	2-11	2-12	2-13
P23	1	2-1	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	1-13

Note: The shading used in the above table shows discontinuity of the routing sequence across rows and columns in the table.

A Dual Star or Dual-Dual Star backplane will use a sub-set of this same Channel routing method. In the case of the Dual Star backplane, only those between slots 1 & 2 are required. The Full Mesh backplane is capable of supporting Mesh and Star system topologies determined by the types of boards installed. For example, a Dual Star system configuration is created by installing Hub Boards into Logical Slots 1 & 2 and Node Boards into all other slots.

FABRIC INTERFACE DUAL STAR

A backlane that supports only Dual Star configuration results from a Full Mesh backplane by depopulating all routing traces and backplane connectors except those that connect Channels 1 & 2 of each node slot to the Logical Slots 1 & 2 (Hub Slots) and those that connect Logical Slot 1 to Logical Slot 2. In a Dual Star backplane, Logical Slots 1 & 2 are dedicated as Hub Slots with up to 15 Channels each and all other Slots (up to 14) are Node Slots with Channels 1 & 2 mapped to the Hub slots.

14-SLOT DUAL STAR PINOUTS

5U, 14-Slot, Dual Star ATCA Backplane Part# 109ATCA514



14-SLOT DUAL STAR POWER DISTRIBUTION

5U, 14-Slot, Dual Star ATCA Backplane Part# 109ATCA514

Physical SI	ot 1 2	3 4 5	6 7 8	9 10	11 12 13 14
Logical slo	13 11	9 7 5	3 1 2	4 6	8 10 12 14
Source	A/B A/B	A/B A/B A/B	A/B A/B A/B	A/B A/B	A/B A/B A/B A/B

14-SLOT DUAL STAR UPDATE CHANNELS

5U, 14-Slot, Dual Star ATCA Backplane Part# 109ATCA514



14-SLOT DUAL STAR ROUTING DIAGRAM

5U, 14-Slot, Dual Star ATCA Backplane Part# 109ATCA514



SHMC TO BASE CHANNEL JUMPER CONFIGURATION

7U, 14-Slot, Dual Star ATCA Backplane Part# 109ATCA514

Configuration	Settings			
Cross connect B open Ethernet port 1 of J4 SHMC 1 and J5 SHMC 2 connected	JP1-JP16 open R13-R20 installed R21-R28 not installed			
Hub slot 7 (logical slot 1) SHMC cross connect B connected to J4 SHMC 1 Hub slot 8 (logical slot 2) SHMC cross connect B connected to J5 SHMC 2	JP1, JP3, JP5, JP7, JP10, JP12, JP14, JP16 installed JP2, JP4, JP6, JP8, JP9, JP11, JP13, JP15 open R13-R28 not installed			
Hub slot 7(logical slot 1) SHMC cross connect B connected to J5 SHMC 2 Hub slot 8(logical slot 2) SHMC cross connect B connected to J4 SHMC 1	JP1 pin 1 to JP2 pin 1, JP1 pin 2 to JP2 pin 2 JP3 pin 1 to JP4 pin 1, JP3 pin 2 to JP4 pin 2 JP5 pin 1 to JP6 pin 1, JP5 pin 2 to JP6 pin 2 JP7 pin 1 to JP6 pin 1, JP7 pin 2 to JP6 pin 2 JP9 pin 1 to JP10 pin 1, JP9 pin 2 to JP10 pin 2 JP11 pin 1 to JP12 pin 1, JP11 pin 2 to JP12 pin 2 JP13 pin 1 to JP14 pin 1, JP13 pin 2 to JP14 pin 2 JP15 pin 1 to JP16 pin 1, JP15 pin 2 to JP16 pin 2 R13-R28 not installed			

SHELF MANAGER CONNECTOR PINOUT

5U, 2-Slot, Mesh ATCA Backplane, Part # 109ATCA502

5U, 5-Slot, Mesh ATCA Backplane, Part # 109ATCA505

5U, 6-Slot, Mesh ATCA Backplane, Part # 109ATCA506

5U, 14-Slot, Mesh ATCA Backplane, Part# 1900001778

B5 NC CatOut No Connect B6 NC CatOut No Connect B4 AVX FIRST -4VXCA hgut B8 -49XA RTN FIRST -44VXCA hgut B1 NC CatOut No Connect B1 -44VXCA hgut B1 -44VXCA hgut B1 NC CatOut No Connect 91 NC CatOut No Connect B1 AVX CatOut No Connect 91 NC CatOut No Connect B1 AVX CatOut No Connect 91 NC CatOut No Connect F1 AVX CatOut No Connect 93 A40A Sth Sth Sth No Connect F2 NC CatOut No Connect 96 No Connect No Connect No Connect F3 NC CatOut No Connect 191 NC CatOut No Connect F4 NC CatOut No Connect 193 A40A Sthth Sththhhhhhhhhhhhhhhhhhhhhhhhhhhh	Pin No.	Signal	Mating	Pin Function	Pin No.	Signal	Mating	Pin Function
B4 NC Cutbut No Connect B7 NC Cutbut No Connect B3 44V A FIRST 44V0CA Return FIRST 44V0CA Return B4 NC Cutbut No Connect B3 NC Cutbut No Connect B4 A4V FIRST 44V0CA Return No Connect B3 NC Cutbut No Connect T78 NC Cutbut No Connect B3 NC Cutbut No Connect B3 NC Cutbut No Connect B4 449XA RTN FIRST 44V0CA Return No Connect B4 449XA RTN FIRST 44V0CA Return No Connect B4 A49XA RTN FIRST 44V0CA Return No Connect B4 A49XA RETURN FIRST 44V0CA Return No Connect B4 A49XA RETURN FIRST 44V0CA Return No Connect B4 A4XA Return B4 A49XA Return B4 A49XA Return B4 A44XA Return B4 A44XA Return B4 B4								
B0 -44V A FIRST -44V0 C A Input B8 -44V0 A RN FIRST -44V0 C Return 81 NC CutOut No Connect 90 NC CutOut No Connect 81 NC CutOut No Connect 90 NC CutOut No Connect 81 AVA FIRST -44V0 C Return No Connect 91 No Connect No Connect 92 No Connect No Connect 93 NC CutOut No Connect 94 44VA RTN FIRST -44V0 C A Return 77 -44VA FIRST -44V0 C A Return No Connect 94 44VA RTN No Connect No								
B2 NC Curbal No Connect B9 NC Curbal No Connect B9 NC Curbal No Connect B1 NC Curbal No Connect B1 NC Curbal No Connect B1 NC Curbal No Connect B1 NC Curbal No Connect B5 NC Curbal No Connect T7 44VA FIRST 44VOC A lingui B4 44VA RTN FIRST 44VOC A Ruta T7 44VA FIRST 44VOC A lingui B4 44VA RTN FIRST 44VOC A Ruta T7 44AS SENSE THEO 44VA Senset B9 NC Curbal No Connect B7 T4 MAS SENSE THEO 44VA Senset B1 NC Curbal No Connect T9 MC Curbal No Connect B8 NC Curbal No Connect T9 MC Curbal No Connect B9 MAS								
Bit NC CutOut No. Connect 90 NC CutOut No. Connect 79 46V B FIRST 46V02 B right 92 449VB RTN FIRST 46V02 B Right 79 46V A FIRST MOC A FIRST 46V02 B Right 70 NC CutOut No. Connect 96 NC CutOut No. Connect 71 NC CutOut No. Connect 97 NC CutOut No. Connect 72 MC CutOut No. Connect 97 NC CutOut No. Connect 73 MC CutOut No. Connect 97 NC CutOut No. Connect 74 MC CutOut No. Connect 97 No. Connect MAX Sense ftr 70 NC CutOut No. Connect 103 NC CutOut No. Connect 68 MXC CutOut No. Connect 103 NC CutOut No. Connect 68								
B0 NC CutOut No Connect 91 NC CutOut No Rest 78 449/0 B FIRST 440/02 B Rest Advoct B No Connect No Connect </th <th>81</th> <th></th> <th></th> <th></th> <th>90</th> <th></th> <th></th> <th></th>	81				90			
P3	80				91			
T7 44V A FIRST 44VO C Any C A	79				92			-48VDC B Return
T6 NC Guidut No Connect 95 NC Guidut No Connect 75 NC Guidut No Connect 97 NC Guidut No Connect 73 448.5 BLNSE THRD 449.4 X3 Sense 98 448.4 RN SENSE THRD 449.4 X3 Sense 76 70 NC Guidut No Connect 101 NC Guidut No Connect 70 NC Guidut Adv Ad Sense 102 448.4 RN SENSE THRD 449.4 Senses THRD 449.4 Se	78	NC	CutOut	No Connect	93	NC	CutOut	No Connect
T5 NC Guidut No Connect 96 NC Guidut No Connect 74 MAS SENSE THIRD 449/A 35 mm Str THIRD 449/A 35 mm Str 72 MAS SENSE THIRD 449/A 35 mm Str THIRD 449/A 35 mm Str 71 440/A TSS SENSE THIRD 449/A 55 mms THIRD 449/A 55 m					94			
P74 NC CurOut No Connect 97 NC CurOut No Connect 73 4BA3 SENSE THURO 48V A3 Sense 98 4403 ATM SENSE THURO 48V A3 Sense 71 4BA ESISE THURO 48V A4 Sense 100 49A ATM SENSE 48V A4 Sense 70 NC CurOut No Connect 100 49A ATM SENSE 4400 AtM A4 Sense 71 4BA ESISE CurOut No Connect 100 49A Connect 440 AtM A4 Sense 86 440 NE CurOut No Connect 103 440 Connect 460 Connect 66 86 MC CurOut No Connect 109 NC CurOut No Connect 86 440 Sense FIRST 440 Connect 101 480 Sense CurOut No Connect 86 MC CurOut No Connect 111 NC CurOut No Connect 81 MS SENSE CurOut No Connect 1113 NC CurOut	76	NC	CutOut	No Connect	95	NC	CutOut	No Connect
T3 .448.3 ERUS THIRD .48V A3 Sense III Pail A48 SENSE THIRD .48V A3 Sense III T2 MC Guidold MC Connect 99 MC Guidold MC Connect T0 MC Guidold MC Connect 100 44A4 RTN SENSE THIRD 44A4 Sense III 66 MC CS Cuidold MC Connect 101 MC CS Guidold MC Cancer 67 MC CS Cuidold MC Connect 102 44A5 RTN SENSE THIRD 44V A4 Sense 102 Guidold MC Cancer 66 MC C Cuidold No Connect 102 NC C Guidold MC Cancer 44V CB FIRST 44V/CB Sense 101 44S MC C Guidold MC Cancer 44V/CB Sense 101 44S NC C Guidold MC Cancer 44V/CB Sense 111 44S MC Cancer 101 44V/CB Sense 111 44S 111 MC Cancer 101 44V/CB Sense 111 44S 111 44SH SENSE	75	NC	CutOut		96	NC	CutOut	No Connect
TZ NC CulOut No Connect 99 NC CulOut No Connect T0 448.4 ENSE THUD 449.4 K Sense 100 449.4 TN SENSE TWU 449.4 AS Sense 100 449.4 TN SENSE TWU 449.4 AS Sense 101 NC CulOut No Connect 101 NC CulOut No Connect 101 NC CulOut No Connect 102 448.5 TN SENSE TWU 449.4 AS Sense 102 449.4 CulOut No Connect 109 No C CulOut No Connect 109 No C CulOut No Connect 109 A8.7 CulOut No Connect 109 No C CulOut No Connect 109 A80.5 SENSE THIRD 449.4 Sensense	74		CutOut	No Connect	97	NC	CutOut	No Connect
T1 -48/4 48/4 Assess 100 -48/4 RTN SERSE THIRD -48/4 Assess 101 NC Culoud No< Connect	73	-48A3 SENSE	THIRD	-48V A3 Sense	98	-48A3 RTN SENSE	THIRD	-48V A3 Sense Rtn
TO NC CutOut No Connect 101 NC CutOut No Connect 69 448/45 Stense TIR NC CutOut No Connect 102 448/45 RTN SENSE TIRD 449/45 Stense TIR 67 NC CutOut No Connect 103 NC CutOut No Connect 68 AdV B FIRST 440/DC B Incut 106 449/3 RTN No Connect 68 AdV B FIRST 440/DC B Incut 109 440/3 RTN Mo Connect 64 NC CutOut No Connect 109 NC CutOut No Connect 62 NC CutOut No Connect 109 NC CutOut No Connect 64 NC CutOut No Connect 113 NO CutOut No Connect 68 NC CutOut No Connect 113 NO CutOut No Connect 68 NC CutOut No Connect 113 NO	72	NC	CutOut	No Connect	99	NC	CutOut	No Connect
69 4465 SENSE THIRD 449 / A Sense 102 440A RTN SENSE THIRD 440 / A Sense Rth 67 NC CutOut No Connect 104 NC CutOut No Connect 65 AC CutOut No Connect 105 NC CutOut No Connect 64 NC CutOut No Connect 109 45V B RTN FIRST 46V/C B Feurit 64 NC CutOut No Connect 109 45V D RTN FIRST 46V/C B Feurit 64 NC CutOut No Connect 110 480 S Sense TN FIRST	71	-48A4 SENSE	THIRD	-48V A4 Sense	100	-48A4 RTN SENSE	THIRD	-48V A4 Sense Rtn
68 NC Cutbul No Connect 193 NC Cutbul No Connect 66 NC Cutbul No Connect 195 NC Cutbul No Connect 68 ASV B FIRST -44VDC B Input 195 AVV B RTN -44VDC B Input 64 NC Cutbul No Connect 197 NC Cutbul No Connect 64 NC Cutbul No Connect 199 NC Cutbul No Connect 62 NC Cutbul No Connect 199 NC Cutbul No Connect 64 ARES SENSE THIRD -44V AS Sense 111 NC Cutbul No Connect 65 NC Cutbul No Connect 113 NC Cutbul No Connect 66 NC Cutbul No Connect 116 NC Cutbul No Connect 67 4485 SENSE THIRD ARE YB SENSE THIRD ARE YB SENSE THIRD	70		CutOut	No Connect	101	NC	CutOut	No Connect
6F NC Cutbul No Connect 194 NC Cutbul No Connect 66 ABV B FIRST 44VCC B Ruput 196 44V B RTN FIRST 4VCC B Ruput 64 NC Cutbul No Connect 197 NC Cutbul No Connect 63 NC Cutbul No Connect 199 NC Cutbul No Connect 64 ARC Cutbul No Connect 199 ARC No Connect No Connect 64 AREXINE THIRD Adv AS Sense THIRD Adv AS Sense THIRD No Connect 64 NC Cutbul No Connect 113 ARK No Connect No Connect <th>69</th> <th>-48A5 SENSE</th> <th>THIRD</th> <th>-48V A5 Sense</th> <th>102</th> <th>-48A5 RTN SENSE</th> <th>THIRD</th> <th>-48V A5 Sense Rtn</th>	69	-48A5 SENSE	THIRD	-48V A5 Sense	102	-48A5 RTN SENSE	THIRD	-48V A5 Sense Rtn
66 NC CutQut No Connect 105 VMC CutQut No Connect 64 NC CutQut No Connect 107 NC CutQut No Connect 63 NC CutQut No Connect 109 NC CutQut No Connect 61 4583 SENSE CutQut No Connect 109 NC CutQut No Connect 60 NC CutQut No Connect 110 480 ES Sense No Connect 100 480 ES Sense No Connect 111 No Connect 100 480 ES Sense 112 4484 ES Sense 114 4485 First ENE 100 100 Connect 115 480 ES Sense 114 4485 First ENE 100 Connect 116 No Connect 116 No Connect 117 No Connect 100 No Connect 118 No Connect 100 No First 100 Gir Gor OUND 100 Gir Gor OUND 100 TAC+5 SECOND First 100 Gir Gor OUND 100 TAC+5 SECOND First 100 Gir Gor OUND 112 TAC+6 SECOND First	68	NC	CutOut	No Connect	103	NC	CutOut	No Connect
65 45V B FIRST 449VC B Input. 196 44V B RTN FIRST 449VC B Return 63 NC CutOut No Connect 199 NC CutOut No Connect 61 NC CutOut No Connect 199 NC CutOut No Connect 61 4883 SENSE THIRD 449V A Sense 110 4483 RTN SENSE THIRD No Connect 68 MC CutOut No Connect 113 NC CutOut No Connect 68 NC CutOut No Connect 113 NC CutOut No Connect 64 NC CutOut No Connect 115 NC CutOut No Connect 64 NC CutOut No Connect 115 NC CutOut No Connect 64 NC CutOut No Connect 115 NC CutOut No Connect 63 GND FIRST LociCot ROUND 118 No Connect No Conn	67	NC	CutOut	No Connect	104	NC	CutOut	No Connect
64 NC Curlout No Connect 197 NC Curlout No Connect 63 NC Gurlout No Connect 199 NC Curlout No Connect 61 4683 SENSE THRD 469/3 Sense Rt NC Curlout No Connect 89 4684 SENSE THRD 469/9 Sense Rt NC Curlout No Connect 89 4685 SENSE THRD 469/9 Sense Rt No Connect TI3 NC Curlout No Connect 64 465 SENSE THRD 469/9 Sense Rt THRD 469/9 Sense Rt 64 NC Curlout No Connect TI7 NC Curlout No Connect 64 NC Curlout No Connect TI7 NC Curlout No Connect 64 NC Curlout No Connect TI7 NC Curlout No Connect 64 NC Curlout No Connect TI7 NC Curlout No Connect </th <th>66</th> <th>NC</th> <th>CutOut</th> <th>No Connect</th> <th>105</th> <th>NC</th> <th>CutOut</th> <th>No Connect</th>	66	NC	CutOut	No Connect	105	NC	CutOut	No Connect
63 NC CurtOut No Connect 199 NC CurtOut No Connect 61 4893 SENSE THIRD 48V A3 sense 110 4883 RTN SENSE THIRD 48V A3 sense 110 4883 RTN SENSE THIRD 48V A5 Sense THIRD A8V A5 Sense A8V A5 Sense	65	-48V B	FIRST	-48VDC B Input	106	-48V B RTN	FIRST	-48VDC B Return
62 NC Curtout No Connect 1109 NC Curtout No Connect 60 NC Curtout No Connect 1111 NC Curtout No Connect 69 4488 SENSE THIRD 448V M3 Sense THIRD 448V M3 Sense 68 NC Curtout No Connect 113 NC Curtout No Connect 66 NC Curtout No Connect 116 MSE THIRD 448V S5 Sense 66 NC Curtout No Connect 116 NC Curtout No Connect 64 NC Curtout No Connect 117 NC Curtout No Connect 63 GND FIRST LOGIC GROUND 119 OND FIRST LOGIC GROUND 64 PMMS OUT FIRST LOGIC GROUND 122 TFCHT SECOND Fan tachometer 58 64 OND FIRST LOGIC GROUND 124 TACH7 SECOND Fan tachometer 58	64	NC	CutOut	No Connect	107	NC	CutOut	No Connect
61 4483 SENSE THIRD -48V A3 Sense 110 -483 ATN SENSE THIRD -48V B4 Sense 111 NC Curtout No Connect 69 4884 SENSE THIRD -48V B4 Sense 111 NC Curtout No Connect 113 NC Curtout No Connect 67 4885 SENSE THIRD -48V B5 Sense 114 -4885 RTN SENSE THIRD A8V B5 Sense 116 NC Curtout No Connect 116 NC Curtout No Connect 116 NC Curtout No Connect 117 NC Curtout No Connect 118 OND FIRST LOGIC GROUND 118 OND FIRST LOGIC GROUND 120 TACH5 SECOND Fan tachometer 58 000 Fan tachometer 58 000 Fan tachometer 58 000 First LOGIC GROUND 122 TACH6 SECOND Fan tachometer 58 000 Fan tachometer 58 000 Fan tachometer 58 000 Fan tachometer 58 000 Fan tachometer 58 0000 Fan tachomete	63	NC	CutOut	No Connect	108	NC	CutOut	No Connect
61 4483 SENSE THIRD -48V A3 Sense 110 -483 AEN SENSE THIRD -48V B4 Sense 111 NC Curtout No Connect 69 4884 SENSE THIRD -48V B4 Sense 111 NC Curtout No Connect 113 NC Curtout No Connect 116 NC Curtout No Connect 117 NC Curtout No Connect 118 GND FIRST LOGIC GROUND 118 GND FIRST LOGIC GROUND 120 TACHS SECOND Fan Tachometer Sign 69 PVM0 QUT THIRD Fan PVMS Sgnal 122 TACHS SECOND Fan Tachometer Sign 69 PVM0 QUT THIRD Fan PVMS Sgnal 122 TACHS SECOND Fan Tachometer Sign	62	NC			109			
60 NC Curdout No Connect 111 NC Curdout No Connect 69 4484 SENSE THIRD 442 VB Sense Rt No No Curdout No Connect 113 NC Curdout No Connect 113 NC Curdout No Connect 113 NC Curdout No Connect 116 NC Curdout No Connect 116 NC Curdout No Connect 117 NG Curdout No Connect 118 NC Curdout No Connect 119 OND FIRST LOGIC GROUND 119 Curdout No Connect 119 Curdout No Conn			THIRD				THIRD	-48V B3 Sense Rtn
58 NC CutOut No Connect 113 NC CutOut No Connect 57 4485 SENSE THRD 4490 B5 Sense THRD 4490 B5 Sense 58 NC CutOut No Connect THRD 4490 B5 Sense 54 NC CutOut No Connect THRD 4490 B5 Sense 53 GND FIRST LOGIC GROUND THR No Connect 51 FWMO QUT THIRD Fan FWM Signal 120 TACH5 SECOND Fan Tachometer Signal 50 PWM QUT THIRD Fan FWM Signal 121 FTFOUT SECOND Fan Tachometer Signal 47 PWMA QUT THIRD Fan FWM Signal 122 TACH6 SECOND Fan Tachometer Signal 46 GND FIRST LOGIC GROUND 125 GND First Encore SIGURUND 47 PWMA QUT THIRD Fan PWM Signal 122 TACH9 SECOND Fan Tachometer Signal 48 FIRT LOGIC GROUND 125 GND FIRT LOG			CutOut				CutOut	
F7		-48B4 SENSE						-48V B4 Sense Rtn
56 NC Cutlout No Connect 115 NC Cutlout No Connect 54 NC Cutlout No Connect 117 NC Cutlout No Connect 53 GND FIRST LOGIC GROUND 118 GND FIRST LOGIC GROUND 51 PWM OUT THIRD Fan PVM Signal 120 TACH5 SECOND Fan tax hal signal 50 PWM OUT THIRD Fan PVM Signal 121 FTFOUT SECOND Fan tax hal signal 49 GND FIRST LOGIC GROUND 122 TACH6 SECOND Fan tax hal signal 47 PWMS QUT THIRD Fan PVM Signal 124 TACH1 SECOND Fan tax hal signal 48 GND FIRST LOGIC GROUND 125 GND FIRST ELOGIC GROUND 43 FILTER0 SECOND Ar Filter Present Signal 127 TACH9 SECOND Fan Tax harbreest Signal 44 FILTER3 SECOND Ar Filter Present Signal 130 GND FIRST			CutOut				CutOut	No Connect
65 NC CutOut No Connect 116 NC CutOut No Connect 63 GND FIRST LOGIC GROUND 118 GND FIRST LOGIC GROUND 62 GND FIRST LOGIC GROUND 119 GND FIRST LOGIC GROUND 61 PWM0 OUT THIRD Fan PVM Signal 120 TACH5 SECOND Fan tark an alignand 69 PWM0 OUT THIRD Fan PVM Signal 123 TACH6 SECOND Fan tark an alignand 48 PWM3 OUT THIRD Fan PVM Signal 124 TACH7 SECOND Fan tark an alignand 47 PWM3 OUT THIRD Fan PVM Signal 126 TACH1 SECOND Fan tark an alignal 46 GND FIRST LOGIC GROUND 126 TACH1 SECOND Fan tark an alignal 41 FILTER0 SECOND Ar Filter Present Signal 130 GND FIRST LOGIC GROUND 42 R APES# SECOND Ar Filter Present Signal 130 GND				-48V B5 Sense		-48B5 RTN SENSE	THIRD	-48V B5 Sense Rtn
54 NC CutOut No connect 117 NC CutOut No connect 53 GND FIRST LOGIC GROUND 118 GND FIRST LOGIC GROUND 54 PWM0 OUT THIRD Fan PVMS Signal 120 TACH5 SECOND Fan Tarw fait signal 59 PVM1 OUT THIRD Fan PVMS Signal 121 FTFOUT 6 SECOND Fan Tarw fait signal 49 GND FIRST LOGIC GROUND 122 TACH6 SECOND Fan Tarw fait signal 47 PVM3 OUT THIRD Fan PVM Signal 124 TACH6 SECOND Fan Tarw fait signal 45 PRES# LAST Present Signal 126 TACH8 SECOND Fan Tarchometer Signal 44 FLITER1 SECOND Air Filter Present Signal 126 TACH10 SECOND Fan Tarchometer Signal 43 FLITER3 SECOND Air Filter Present Signal 130 OND Filter Present Signal 131 PRES# LOCIC GR								
53 GND FIRST LOGIC GROUND 118 GND FIRST LOGIC GROUND 52 GND FIRST LOGIC GROUND 119 GND FIRST LOGIC GROUND 50 PVMM OUT THIRD Fan PVM Signal 120 TACH5 SECOND Fan tark misingan 49 GND FIRST LOGIC GROUND 122 TACH6 SECOND Fan tark misingan 49 GND FIRST LOGIC GROUND 123 FIFCUT 7. SECOND Fan tark misingan 49 GND FIRST LOGIC GROUND 124 TACH7 SECOND Fan tark misingan 41 FILTER0 SECOND Air Filter Present Signal 128 TACH10 SECOND Fan tark misingan 42 R PRE5# ESCOND Air Filter Present Signal 130 GND First LOGIC GROUND 43 FILTER3 SECOND Air Filter Present Signal 131 PEM SECOND Fan tark misingan 44 FILTER3 SECOND								
52 GND FIRST LOGIC GROUND 119 GND FIRST LOGIC GROUND 51 PVM0 OUT THIRD Fan PVM Signal 120 TACH5 SECOND Fan trav fail spans 49 GND FIRST LOGIC GROUND 121 TACH5 SECOND Fan trav fail spans 41 PVM2 OUT THIRD Fan PVMS Signal 123 FTFOUT SECOND Fan trav fail spans 42 PVM3 OUT THIRD Fan PVMS Signal 124 TACH6 SECOND Fan tachometer Signal 43 FILTER0 SECOND Air Filter Present Signal 127 TACH9 SECOND Fan tachometer Signal 41 FILTER3 SECOND Air Filter Present Signal 130 GND Filter TACH9 SECOND Fan tachometer Signal 32 RLVER SECOND Air Filter Present Signal 130 GND Filter3 LOGIC GROUND 34 FILTER3 SECOND Fan tachometer Signal 134 EitRP THIRD								
St. PYMM OUT THIRD Fan PYM Signal 120 TACH5 SECOND Fan tarking lisignal 49 GND FIRST LOGIC GROUND 122 TACH6 SECOND Fan tarking lisignal 47 PYM3 OUT THIRD Fan PYM Signal 123 FIFOUT 7. SECOND Fan tarking lisignal 47 PYM3 OUT THIRD Fan PYM Signal 124 TACH7 SECOND Fan tarking lisignal 46 GND FIRST LOGIC GROUND 126 GND FIRST LOGIC GROUND 47 FILTER0 SECOND Air Filter Present Signal 128 TACH10 SECOND Fan tarkoneter Signal 48 FILTER3 SECOND Remote Present Signal 130 GND FIRST LOGIC GROUND 41 FILTER3 SECOND Fan tark Present Signal 131 PEM Present Signal 133 GND FIRST LOGIC GROUND 439 GND FIRST LOGIC GROUND 132 PEM4 SECOND PEM Prese				LOGIC GROUND			FIRST	
50 PVMM OUT THIRD Fan PVM Signal 121 FTFOUT 6 SECOND Fan tark fail signal 49 GND FIRST LOGIC GROUND 123 FTFOUT 7 SECOND Fan tark fail signal 47 PVM8 QUT THIRD Fan PVM Signal 123 FTFOUT 7 SECOND Fan tark fail signal 46 OND FIRST LOGIC GROUND 126 TACH8 SECOND Fan Tachometer Signal 43 FILTERI SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tachometer Signal 43 FILTERI SECOND Remote Present 130 GND FIRST LOGIC GROUND 44 FILTERI SECOND Fan Tachometer Signal 130 GND FIRST LOGIC GROUND 132 PEMS SECOND PM Present Signal 39 GND FIRST LOGIC GROUND 132 PEMS SECOND PM Present Signal 34 ETP 0 SECOND Fan Tachometer Signal 134 ETR THIRD Etherent 1 Rx-								
49 GND FIRST LOGIC GROUND 122 TACH6 SECOND Fan Tachometer Signal 47 PWM3 OUT THIRD Fan PWM Signal 123 FTFOUT TSECOND Fan Tachometer Signal 45 GND FIRST LOGIC GROUND 125 GND FIRST LOGIC GROUND 44 FILTERI SECOND Air Filter Present Signal 126 TACH8 SECOND Fan Tachometer Signal 43 FILTERI SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tachometer Signal 44 FILTERI SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 45 GND FIRTST LOGIC GROUND 122 PEM4 SECOND PM Present Signal 38 L HUY# FIRST LOGIC GROUND 123 PEM4 SECOND PM Present Signal 39 GND Fan Tacheenes Signal 131 PEM4 SECOND PM Present Signal 30 FTP 1 SECOND Fan Tacheenes Signal 134 ETR T								Fan Tachometer Signal
48 PVWA2 OUT THIRD Fan PVM Signal 123 FTFOUT 7 SECOND Fan tark fai sganal 47 PVW3 OUT THIRD Fan PVM Signal 124 TACH7 SECOND Fan Tark fai sganal 45 GND FIRST LOGIC GROUND 125 GND FiRST LOGIC GROUND 44 FILTER0 SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tarkometer Sig 43 FILTER1 SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 40 FILTER2 SECOND Fan Tark Present Signal 131 PEM5 SECOND PEM Present Signal 38 L.HLY# FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 36 FTP 0 SECOND Fan Tary Present Signal 135 GND FIRST LOGIC GROUND 37 FTP 0 SECOND Fan Tary Present Signal 137 E1TN THIRD Ethemet 1 TX: 33 <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>								
47 PWM8.0UT THIRD Fan PWM Signal 124 TACH7 SECOND Fan Tachometer Signal 46 GND FIRST LOGIC GROUND 126 GND FIRST LOGIC GROUND 45 PILTERI SECOND Air Filter Present Signal 127 TACH9 SECOND Fan Tachometer Signal 43 FILTERI SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tachometer Signal 41 FILTER3 SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 39 GND FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 34 FTP 0 SECOND Fan Tax Present Signal 134 ETRP THIRD Ethernet 1 RX- 36 FTP 1 SECOND Fan Tax Present Signal 135 GND FIRST LOGIC GROUND 36 FTP 2 SECOND Fan Tax Present Signal 134 ETRP THIRD Ethernet 1 RX- 36 FTP 2 SECOND </th <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>								
46 GND FIRST LOGIC GROUND 125 GND FIRST LOGIC GROUND 45 PRES# LAST Present Signal 127 TACHB SECOND Fan Tachometer Signal 43 FILTER1 SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tachometer Signal 43 FILTER3 SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 40 FILTER3 SECOND Air Filter Present Signal 131 PEM4 SECOND PEM Present Signal 38 L.H.Y# FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 38 L.H.Y# FIRST LOGIC GROUND 132 GND FIRST LOGIC GROUND 38 L.H.Y# FIRST LOGIC GROUND 132 GND FIRST LOGIC GROUND 36 R.H.Y# FIRST Remote Healthy 138 EITN THRD Ethernet 17X- 36 R.H.Y# FIRST LOGIC GROUND 139								
45 PRES# LAST Present Signal 126 TACHB SECOND Fan Tachometer Signal 44 FILTER1 SECOND Air Filter Present Signal 127 TACH10 SECOND Fan Tachometer Signal 42 R PRES# SECOND Air Filter Present Signal 128 TACH10 SECOND Fan Tachometer Signal 41 FILTER3 SECOND Air Filter Present Signal 130 GND FiltER1 LOGIC GROUND 39 GND FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 38 L HLY# FIRST LOGIC GROUND 133 ETRN THIRD Ethernet 1Rx- 36 FTP 1 SECOND Fan Tary Present Signal 135 GND FIRST LOGIC GROUND 34 FTP 2 SECOND Fan Tary Present Signal 137 Et1TP THIRD Ethernet 17x- 33 FTP 3 SECOND Fan Tary Present Signal 137 Et1TP THIRD Ethernet 17x-								
44 FILTER0 SECOND Air Filter Present Signal 127 TACH10 SECOND Fan Tachometer Sig 42 R PRES# SECOND Air Filter Present Signal 130 GND FiltER1 SECOND Fan Tachometer Sig 41 FILTER2 SECOND Air Filter Present Signal 130 GND FiltER1 LOGIC GROUND 39 GND FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 38 L HLY# FIRST LOGIC GROUND 132 PEM4 SECOND PEM Present Signal 37 FTP 0 SECOND Fan Tay Present Signal 134 ETR1 LOGIC GROUND 36 R HLY# FIRST Remote Healthy 136 ETNT THIRD Ethernet 17X- 33 FTP 3 SECOND Fan Tay Present Signal 139 GND FIRST LOGIC GROUND 32 GND FIRTST LOGIC GROUND 139 RXIN THIRD Ethermet 17X- <tr< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr<>								
43 FILTER1 SECOND Air Filter Present 128 TACH10 SECOND Fan Tachometer Signal 42 R PRES# SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 40 FILTER3 SECOND Air Filter Present Signal 131 PEMS SECOND FRST LOGIC GROUND 39 GND FIRST LOGIC GROUND 132 PEMM SECOND FEM Present Signal 38 L HUY# FIRST Local Healthy 133 E1RN THIRD Ethernet 1 RX- 36 FTP 1 SECOND Fan Tary Present Signal 135 GND FIRST LOGIC GROUND 36 FTP 2 SECOND Fan Tary Present Signal 137 E1TP THIRD Ethernet 1 TX- 39 GND FIRST LOGIC GROUND 139 RX1N THIRD Ethernet 1 TX- 30 FTP 4 SECOND Fan Tary Present Signal 141 GND FIRST LOGIC GROUND 30 FTP 5 SECOND Fan Tary Present Signal 141 GND FIRS								
42 R PRES# SECOND Remote Present 129 TACH11 SECOND Fan Tachometer Sin 41 FILTER2 SECOND Air Filter Present Signal 130 GND FIRST LOGIC GROUND 39 GND FIRST LOCIC GROUND 132 PEMS SECOND PEM Present Signal 38 L HLY# FIRST LOCIC GROUND 132 PEMS SECOND FEM Present Signal 38 L HLY# FIRST Local Meters 134 E1RN THIRD Ethernet 1 RX. 36 FTP 1 SECOND Fan Tray Present Signal 135 GND FIRST LOGIC GROUND 36 R HLY# FIRST Local WriteNever Request 140 RXIN THIRD Ethernet 1 TX. 37 GND FIRST Local WriteNever Request 143 GND FIRST LOGIC GROUND 38 L SWR# FIRST LOGIC GROUND 139 RXIN THIRD Ethernet 1 RX. 30 FTP 4 <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>Fan Tachometer Signal</th></t<>								Fan Tachometer Signal
41FILTER2SECONDAir Filter Present Signal130GNDFIRSTLOGIC GROUND40FILTER3SECONDAir Filter Present Signal131PEM5SECONDPEM Present Signal38L HLY#FIRSTLOGIC GROUND132PEM4SECONDPEM Present Signal38L HLY#FIRSTLocal Healthy133E1RNTHIRDEthernet 1RX-36FTP 1SECONDFan Tray Present Signal134E1RNTHIRDEthernet 1RX-36FTP 2SECONDFan Tray Present Signal135GNDFIRSTLOGIC GROUND33FTP 3SECONDFan Tray Present Signal137E1TPTHIRDEthernet 1TX-33FTP 3SECONDFan Tray Present Signal137E1TPTHIRDEthernet 1TX-34FTP 4SECONDFan Tray Present Signal137E1TPTHIRDEthernet 1TX-35GNDFIRSTLOGIC GROUND139RX1NTHIRDEthernet 1TX-36FTP 4SECONDFan Tray Present Signal141GNDFIRSTLOGIC GROUND29FTP 5SECONDFan Tray Present Signal142TX1NTHIRDEthernet 1TX-37PEMSECONDPEM Present Signal144GNDFIRSTLOGIC GROUND29FTP 5SECONDPEM Present Signal144GNDFIRSTLOGIC GROUND26PEM1SECONDPEM Present Signal144G								Fan Tachometer Signal
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12 GND FIRST LOGIC GROUND 159 12C 2 INT THIRD 12C Bus Interupt 11 5VOUT LAST 5V Output 160 GND FIRST LOGIC GROUND 10 5VOUT LAST 5V Output 161 12C 3 INT THIRD 12C Bus Interupt 9 GND FIRST LOGIC GROUND 161 12C 3 SCL THIRD 0ff board 12C bus 8 FTFOUT 2 SECOND Fan tray fail signal 163 12C 3 SDA THIRD 0ff board 12C bus 7 TACH2 SECOND Fan tray fail signal 164 GND FIRST LOGIC GROUND 6 FTFOUT 3 SECOND Fan tray fail signal 166 USB0M THIRD Primary USB- 4 FTFOUT 4 SECOND Fan tachometer Signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tachometer Signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SE	18 17 16 15 14	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6	SECOND SECOND SECOND SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan tray fail signal Fan Tachometer Signal Fan Tray Present Signal	154 155 156 157	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL	FIRST THIRD THIRD FIRST THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus
10 5VOUT LAST 5V Output 161 I2C 3 INT THIRD I2C 8us Interupt 9 GND FIRST LOGIC GROUND 162 I2C 3 SCL THIRD Off board I2C bus 8 FTFOUT 2 SECOND Fan tray fail signal 163 I2C 3 SDA THIRD Off board I2C bus 7 TACH2 SECOND Fan Tachometer Signal 164 GND FIRST LOGIC GROUND 6 FTFOUT 3 SECOND Fan Tachometer Signal 165 USB0P THIRD Primary USB+ 5 TACH3 SECOND Fan Tachometer Signal 166 USB0M THIRD Primary USB+ 4 FTFOUT 4 SECOND Fan tachometer Signal 168 USB0P FIRST LOGIC GROUND 3 TACH4 SECOND Fan tachometer Signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tachometer Signal 169 USBDM THIRD Secondary USB+	18 17 16 15 14 13	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7	SECOND SECOND SECOND SECOND SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan tray fail signal Fan Tachometer Signal Fan Tray Present Signal Fan Tray Present Signal	154 155 156 157 158	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA	FIRST THIRD THIRD FIRST THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus
9 GND FIRST LOGIC GROUND 162 I2C 3 SCL THIRD Off board I2C bus 8 FTFOUT 2 SECOND Fan tray fail signal 163 I2C 3 SDA THIRD Off board I2C bus 7 TACH2 SECOND Fan tray fail signal 164 GND FIRST LOGIC GROUND 6 FTFOUT 3 SECOND Fan tray fail signal 165 USB0P THIRD Primary US8+ 5 TACH3 SECOND Fan tray fail signal 166 USB0M THIRD Primary US8+ 4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tray fail signal 168 USB0P THIRD Secondary US8+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary US8+	18 17 16 15 14 13 12	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND	SECOND SECOND SECOND SECOND SECOND SECOND FIRST	Fan tray fail signal Fan Tachometer Signal Fan tray fail signal Fan Tachometer Signal Fan Tray Present Signal Fan Tray Present Signal LOGIC GROUND	154 155 156 157 158 159	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA I2C 2 INT	FIRST THIRD THIRD FIRST THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt
8 FTFOUT 2 SECOND Fan tray fail signal 163 I2C 3 SDA THIRD Off board I2C bus 7 TACH2 SECOND Fan Tachometer Signal 164 GND FIRST LOGIC GROUND 6 FTFOUT 3 SECOND Fan tray fail signal 165 USB0P THIRD Primary USB+ 5 TACH3 SECOND Fan tray fail signal 166 USB0M THIRD Primary USB+ 4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tray fail signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB+	18 17 16 15 14 13 12 11	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT	SECOND SECOND SECOND SECOND SECOND SECOND FIRST LAST	Fan tray fail signal Fan Tachometer Signal Fan tray fail signal Fan Tachometer Signal Fan Tray Present Signal Fan Tray Present Signal LOGIC GROUND 5V Output	154 155 156 157 158 159 160	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA I2C 2 INT GND	FIRST THIRD THIRD FIRST THIRD THIRD THIRD FIRST	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND
7 TACH2 SECOND Fan Tachometer Signal 164 GND FIRST LOGIC GROUND 6 FTFOUT 3 SECOND Fan tray fail signal 165 USB0P THIRD Primary USB+ 5 TACH3 SECOND Fan Tachometer Signal 166 USB0M THIRD Primary USB+ 4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tray fail signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB+	18 17 16 15 14 13 12 11 10	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT 5VOUT	SECOND SECOND SECOND SECOND SECOND FIRST LAST LAST	Fan tray fail signal Fan Tachometre Signal Fan tray fail signal Fan Tachometer Signal Fan Tray Present Signal LOGIC GROUND SV Output SV Output	154 155 156 157 158 159 160 161	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA I2C 2 INT GND I2C 3 INT	FIRST THIRD THIRD FIRST THIRD THIRD THIRD FIRST THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt
6 FTFOUT 3 SECOND Fan tray fail signal 165 USB0P THIRD Primary USB+ 5 TACH3 SECOND Fan Tachometer Signal 166 USB0M THIRD Primary USB+ 4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tray fail signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB+	18 17 16 15 14 13 12 11 9	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT 5VOUT GND	SECOND SECOND SECOND SECOND SECOND FIRST LAST LAST FIRST	Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal Fan Tachometer Signal Fan Tray Present Signal Fan Tray Present Signal LOGIC GROUND SV Output LOGIC GROUND	154 155 156 157 158 159 160 161 162	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA I2C 2 INT GND I2C 3 INT I2C 3 SCL	FIRST THIRD THIRD FIRST THIRD THIRD FIRST THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus
5 TACH3 SECOND Fan Tachometer Signal 166 USB0M THIRD Primary USB- 4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan tray fail signal 168 USBDP THIRD Secondary USB- 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB-	18 17 16 15 14 13 12 11 10 9 8	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT 5VOUT GND FTFOUT 2	SECOND SECOND SECOND SECOND SECOND FIRST LAST FIRST SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal Fan Tachometer Signal Fan Tray Present Signal LOGIC GROUND 5V Output 5V Output LOGIC GROUND Fan tray fail signal	154 155 156 157 158 159 160 161 162 163	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SDA	FIRST THIRD THIRD FIRST THIRD THIRD FIRST THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus Off board I2C bus
4 FTFOUT 4 SECOND Fan tray fail signal 167 GND FIRST LOGIC GROUND 3 TACH4 SECOND Fan Tachometer Signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB-	18 17 16 15 14 13 12 11 10 9 8 7	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT 5VOUT GND FTFOUT 2 TACH2	SECOND SECOND SECOND SECOND SECOND FIRST LAST LAST FIRST SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal Fan Tray Present Signal Fan Tray Present Signal LOGIC GROUND 5V Output LOGIC GROUND Fan tray fail signal Fan Tachometer Signal	154 155 156 157 158 159 160 161 162 163 164	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SCL 12C 3 SDA GND	FIRST THIRD FIRST THIRD THIRD THIRD FIRST THIRD THIRD THIRD FIRST	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus Off board I2C bus Off board I2C bus
3 TACH4 SECOND Fan Tachometer Signal 168 USBDP THIRD Secondary USB+ 2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB+	18 17 16 15 14 13 12 11 10 9 8 7 6	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT GND FTFOUT 2 TACH2 FTFOUT 3	SECOND SECOND SECOND SECOND SECOND FIRST LAST LAST FIRST SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal Fan Tay fail signal Fan Tray Present Signal LOGIC GROUND SV Output LOGIC GROUND Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal	154 155 156 157 158 159 160 161 162 163 164 165	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SCL 12C 3 SDA GND USC 3 SDA GND USB0P	FIRST THIRD THIRD FIRST THIRD THIRD FIRST THIRD THIRD THIRD THIRD FIRST THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus Off board I2C bus LOGIC GROUND Primary USB+
2 FTFOUT 5 SECOND Fan tray fail signal 169 USBDM THIRD Secondary USB-	18 17 16 15 14 13 12 11 10 9 8 7 6 5	FTFOUT 0 TACH0 FTFOUT 1 FTP 0 FTP 7 GND 5VOUT 5VOUT GND FTFOUT 2 TACH2 FTFOUT 3 TACH3	SECOND SECOND SECOND SECOND SECOND FIRST LAST FIRST SECOND SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tachometer Signal Fan Tary Present Signal Fan Tray Present Signal LOGIC GROUND SV Output SV Output LOGIC GROUND Fan Tary fail signal Fan Tachometer Signal Fan Tachometer Signal	154 155 156 157 158 159 160 161 162 163 164 165 166	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SDA GND USBOP USBOM	FIRST THIRD THIRD FIRST THIRD THIRD FIRST THIRD THIRD FIRST THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus I2C Bus Interrupt LOGIC GROUND I2C Bus Interrupt Off board I2C bus Off board I2C bus LOGIC GROUND Primary USB+ Primary USB+
	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT 5VOUT GND FTFOUT 2 TACH2 FTFOUT 3 TACH3 FTFOUT 4	SECOND SECOND SECOND SECOND SECOND FIRST LAST FIRST SECOND SECOND SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tary fail signal Fan Tary Present Signal Fan Tray Present Signal LOGIC GROUND SV Output LOGIC GROUND Fan tray fail signal Fan Tachometer Signal Fan Tachometer Signal Fan Tachometer Signal	154 155 156 157 158 159 160 161 162 163 164 165 166 167	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SCL 12C 3 SDA GND USBOP USBOM GND	FIRST THIRD THIRD FIRST THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus Off board I2C bus LOGIC GROUND Primary USB+ Primary USB+ LOGIC GROUND
1 GND FIRST LOGIC GROUND 170 GND FIRST LOGIC GROUND	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 6 FTP 7 GND 5VOUT GND FTFOUT 2 TACH2 FTFOUT 3 TACH3 FTFOUT 4 TACH4	SECOND SECOND SECOND SECOND SECOND FIRST LAST FIRST SECOND SECOND SECOND SECOND SECOND SECOND	Fan tray fail signal Fan Tachometer Signal Fan Tay fail signal Fan Tay fail signal Fan Tray Present Signal LOGIC GROUND SV Output LOGIC GROUND Fan tray fail signal Fan Tachometer Signal Fan Tachometer Signal Fan Tachometer Signal Fan Tachometer Signal	154 155 156 157 158 159 160 161 162 163 164 165 166 167 168	I2C 1 SCL I2C 1 SDA GND I2C 2 SCL I2C 2 SDA I2C 2 INT GND I2C 3 INT I2C 3 SCL I2C 3 SDA GND USBOP USBOP USBOP USBOP	FIRST THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD FIRST THIRD THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus I2C Bus Interupt LOGIC GROUND I2C Bus Interupt Off board I2C bus Off board I2C bus LOGIC GROUND Primary USB+ Primary USB- LOGIC GROUND Secondary USB+
	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	FTFOUT 0 TACH0 FTFOUT 1 TACH1 FTP 7 GND 5VOUT 5VOUT FTFOUT 2 TACH2 FTFOUT 3 TACH3 FTFOUT 4 TACH3 FTFOUT 5	SECOND SECOND SECOND SECOND SECOND SECOND FIRST LAST FIRST SECOND SECOND SECOND SECOND SECOND SECOND SECOND SECOND	Fan tray fai signal Fan Tachometer Signal Fan Tachometer Signal Fan Tray Present Signal Fan Tray Present Signal LOGIC GROUND SV Output SV Output LOGIC GROUND Fan tray fai signal Fan Tachometer Signal	154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169	12C 1 SCL 12C 1 SDA GND 12C 2 SCL 12C 2 SDA 12C 2 INT GND 12C 3 INT 12C 3 SDA GND USBOP USBOM GND USBDP USBDP USBDP USBDP	FIRST THIRD THIRD FIRST THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD THIRD	Off board I2C bus Off board I2C bus LOGIC GROUND Off board I2C bus I2C Bus Interrupt LOGIC GROUND I2C Bus Interrupt Off board I2C bus Off board I2C bus Off board I2C bus Off board I2C bus LOGIC GROUND Primary USB+ Primary USB- Secondary USB-

SIGNAL INTEGRITY ENGINEERING

Faster PCB designs are by nature more sophisticated and delicate. At higher clock speeds, the PCB demands cleaner signal transmission without compromising the stability of the system. This is where Signal Integrity engineering comes into play. Simply put, signal integrity studies the design of high-speed circuits that can accommodate cleaner signals passing through them. Cleaner signals, in turn, enable engineers to identify and minimize sources of distortion in data transmission, which could otherwise disrupt timing of the digital logic. Signal integrity issues such as reflections, cross talk, frequency dependent transmission line loss and dispersion can significantly lead to poorer system performance propagating through the interconnect. These SI issues arise from via, power/ground coupling, RLC effects in signal lines, etc. With 3.125 Gbps to 6.250 Gbps signal speeds across the backplane and beyond, an AdvancedTCA backplane is very susceptible to these types of issues.

Below, we will show SI study examples on one of our AdvancedTCA backplanes, the 5-slot Mesh. These are just preliminary studies and the results or design may change at anytime. Consult the factory for further information. The first measurement we will show on the 5-slot ATCA backplane is the fabric impedance. The characteristic impedance of the transmission line is defined by the ratio of the voltage and current at any point as a test pulse travels down a pair of differential backplane traces. [1]. Impedance mismatches (due to vias and connectors) and variations can cause reflections, which degrade the signal quality.

Time Domain Reflectometry (TDR) produces a positive-going incident wave that is applied to the device under test (DUT). The step-pulse travels down the DUT at the velocity of propagation of the line. If the load impedance is equal to the characteristic impedance of the line, no wave is reflected and all that will be seen on the oscilloscope is the incident voltage step recorded as the wave passes the point on the line monitored by the oscilloscope. At every impedance discontinuity that the signal encounters, part of the incident wave is reflected. The reflected voltage wave will appear on the osci loscope [2]. The resulting waveform is like a road map of the impedance variations across the trace.

The worst case connection paths were tested only. That means the longest net length traces were tested. The differential impedance of the backplane and board serial links for Base and Fabric interfaces should be 100 Ohm+- 10%. The measured average value of differential trace line is 107 ohm. Even the worst-case scenario performed within the required range.

For our measurements, we used a wide-bandwidth oscilloscope with 18 GHz measuring bandwidth, high-quality cables, termination resistors, and IConnect analysis software from TDA systems.



Fig1: Layer09_Slot01_P22_AB7 Impedance Waveform

S-PARAMETER

Scattering parameters can capture the reflection and transmission from junctions in backplanes. The ratio of the reflected power to the incident power is the return loss and the ratio of the transmitted power to the incident power is the Insertion loss. These values are derived for defined incremental frequency steps over a range of frequencies that covers the design requirements for the backplane. For AdvancedTCA this was the range from 0 to 5 GHz.



S21 Test Set Up



S11 Test Set Up

The results show that both the Insertion and Return Loss on the 5-slot ATCA backplane under test do not violate the Insertion loss and Return limits for PICMG 3.0.



Layer09_Sig04_AB7 _S21 Waveform



Layer11_Sig05_AB8_S1 Waveform

EYE DIAGRAM

An eye diagram takes the results of a simulation driven by a long, multi-cycle bi sequence, superimposes each bit period over the top of all others—like a time exposure photograph—and presents waveforms that have open areas shaped something like a human eye. The larger the eye opening, the better the results. The most common type of stimulus used in eye-diagram generation is the "PRBS" or "pseudo-random bit sequence." [3] From the result, we can see, trace on layer nine which is routed on slot1 to slot5 still has a more than adequate eye opening (86%) at a PRBS 2^10-1 of 3.125Gbps.



3.125Gbps Reference Eye Height: 500mV



Slot1 to Slot 5 Eye Height: 430mV

PERFORMANCE ASSURED

As you can see from the results above, we were able to show that the 5-slot ATCA backplane performance was well within the specified requirements, even taking the worst-case scenarios. Simulation and characterization capabilities will be increasingly important as we continue to move to higherspeed switch fabric technologies.

Elma Bustronic will continue to publish various SI studies in the coming months. This includes a study on pre-design simulation of an AdvancedTCA backplane. If you have any questions or would like further information of SI capabilities and studies, visit www.elmabustronic.com or contact us at 510-490-7388.



Power Studs



VBP Power Connector



ZD Signal Connectors

DESIGN ELEMENTS

POWER DISTRIBUTION

The Elma Bustronic ATCA backplane family uses the Positronic VPB series, part number VPB30W8F9300A1. Adequate numbers of 48V 6/32 studs are distributed throughout the backplane.

Materials and Finishes - VPB

Insulator: Glass-filled polyester, UL 94V-0, blue color. Contacts: Precision-machined copper alloy with gold flash over nickel plate.

Electrical Characteristics -VPB

Contact Current Ratings, per UL 1977 Size 16 Power Contacts: 30 amperes continuous, all contacts under load. Size 22 Signal Contacts: 2 amperes nominal rating. Initial Contact Resistance; Termination to termination: Size 16 Contacts: 0.0022 ohms maximum, Size 22 Contacts: 0.0085 ohms maximum, Per IEC 512-2, Test 2b. Working Temperature: -55°C to +125°C.

Common Contact Position Function - VPB

1-16 Low Speed Hardware Management
17-24 High Voltage Metallic Test and Ringing Generator Signals
25 Shelf Ground
26 Logic Ground
27/32 Enables for A and B power
28 A Return
29 B Return
30 A Early
31 B Early
33 A Voltage
34 B Voltage

SIGNAL CONNECTORS

The ZD connector is designed to handle over 5 Gbps speeds over standard FR-4 PCB material. The design includes shielded differential pair signal pins for high-performance.

OTHER CONNECTORS

Shelf Management Connectors

Shmc1 connector goes to the Shmc port on slot 1. Shmc2 connector goes to the Shmc port on slot 2.

Metal and Ring Connectors

MT1 and MT2 are TYCO 880222-4. It mates to an EI Series receptacle with crimp termination, such as 172142-4 There is also an MT EI Series with IDC termination.

Ring Connector

The Ring connector is a Molex 71231-0005 which mates with the Molex 71694 and 5557 series.

GLOSSARY

DUAL STAR TOPOLOGY

A fabric topology in which two switch resources provide redundant connections to all end points within the network. The Base Interface is defined as a Dual Star fabric topology for all PICMG 3.0 compliant backplanes. For the Fabric Interface, Dual Star provides the minimum redundant fabric environ ment required for compliant backplane configuration. Up to 14 Node Board/Slots utilize two Fabric Channels to support a connection to each of two Fabric Boards/Slots. Fabric Boards/Slots support a connection to all Node Boards/Slots within a shelf and to the other FabricBoard/Slot.

DUAL-DUAL STAR TOPOLOGY

A fabric topology in which four switch resources provide redundant connections to all end points within the network. Dual-Dual Star configurations may be supported within the Fabric Interface to provide a single highly redundant fabric environment or two redundant fabrics between all boards/slots within a shelf. Up to 12 Node Board/ Slots utilize four Fabric Channels to support a connection to each of 4 Fabric Boards/Slots. Fabric Boards/Slots support a connection to all Node Boards/Slots within a shelf and to the other Fabric Boards/Slots.

FULL MESH TOPOLOGY

A fabric topology in which all network end-points have a direct connection to all other end-points. Full Mesh configurations maybe supported within the Fabric Interface to provide a highly redundant fabric environment capable of very large aggregate bandwidth capacity across the shelf. Full Mesh configured backplanes are capable of supporting Mesh Enabled Boards or Fabric and Node Boards installed in a dual star arrangement.

REPLICATED MESH TOPOLOGY

Because mesh configurations have a distributed fabric they are best suited for these smaller systems since all slots can support processing boards and none need be dedicated to support switching resources. Another approach possible in reduced slot backplanes is to replicate the mesh between slots/boards. Thus signal capacities between boards may be increased between boards in a reduced slot backplane.

BASE INTERFACE

A Zone 2 interface that is used to support 10/100 or 1000BASE-T connections between Boards in a shelf. Backplanes are required to support the Base Interface by routing 4 differential signal pairs between all Node Slots and each Fabric Slot (Logical Slots 1 & 2) Boards may support the Base Interface. If the Fabric interface does not support IP, it is expected that the Base Interface will be used for carrying IP management data between boards within a shelf.

BASE CHANNEL

A physical connection within the Base Interface composed of up to 4 differential signal pairs (1 row) along the Zone 2 ZD connector. Base Channels are mapped to ZD connectors J23/P23 and J24/P24. Base Channels are numbered 1 through 16. Each Base Channel is the endpoint of a slot-to-slot connection within the Base Interface. A Node Slot/Board supports Base Channels 1 & 2 and establishes connections to Logical Slots 1 & 2 respectively. A Base Fabric Slot/Board resides in Logical Slots 1 & 2 and supports connections to al Node/Slots/Boards.

FABRIC ITERFACE

A Zone 2 interface that provides connections comprised of up to 8 differential signal pairs (Channel) between end-points. Compliant backplanes may support the Fabric Interface in a variety of configurations including Full Mesh and Dual Star topologies. Boards that support the Fabric Interface may be configured as Node Boards, Fabric Boards or Mesh Enabled Boards. Compliant board implementations of the Fabric Interface are defined by the PICMG 3.x subsidiary specifications.

FABRIC CHANNEL

A physical connection within the Fabric Interface composed of up to 8 differential signal pairs (2 adjacent rows) along the Zone 2 ZD connector. Fabric Channels are mapped to ZD connectors J20/P20 through J23/P23. Any system slot in a backplane may support between 2 to 15 Channels. Each Fabric Channel is the endpoint of a slot-to-slot connection such that a system slot/board with 2 Channels supports connections to 2 other systems slots/ boards. Fabric Channels are numbered 1 through 15 and slots/boards always support them in sequential order starting with Fabric Channel 1. Fabric Channels are sub-divided into four 2-pair Ports and may be Single Port (2-pair), Double Port (4-pair) or Full Channel (8-pair) implementations.