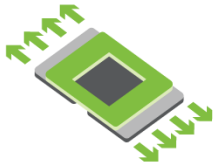
OPEN POSSIBILITIES.

Experience Center- OAI v1.5 Test System

OCP GLOBAL SUMMIT
NOVEMBER 9-10, 2021

OAM v1.5 System Channel Considerations

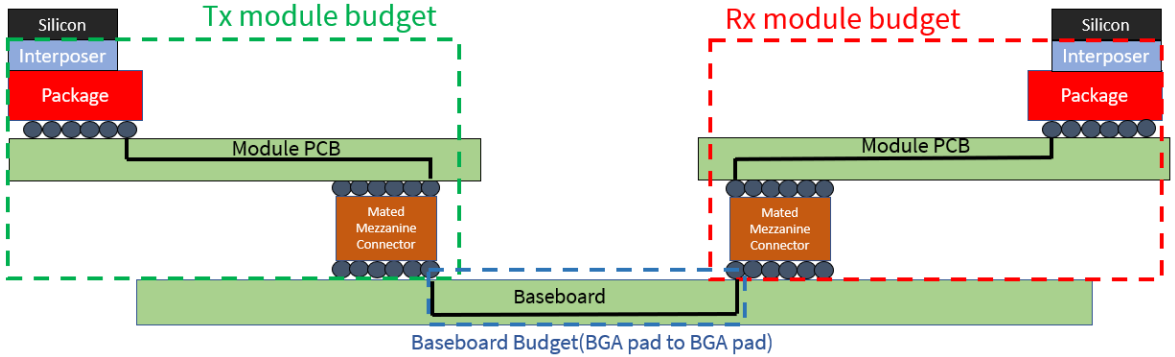


OPEN ACCELERATOR INFRASTRUCTURE

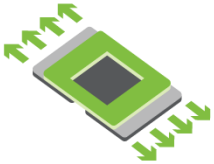
OAM/UBB v1.5 Total Channel Loss Budget (28GHz): 28-30dB

Test fixture goal: Enable channel testing between OAM modules

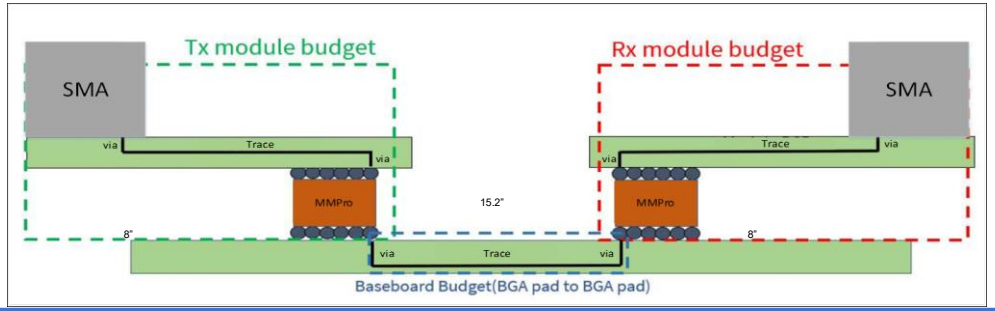
- OAM Tx (**8dB**) + UBB (**12-14dB**) + OAM Rx (**8dB**)



OAM v1.5 Channel Loss Budget



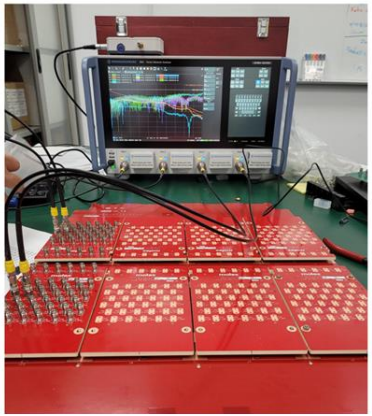
OPEN ACCELERATOR INFRASTRUCTURE

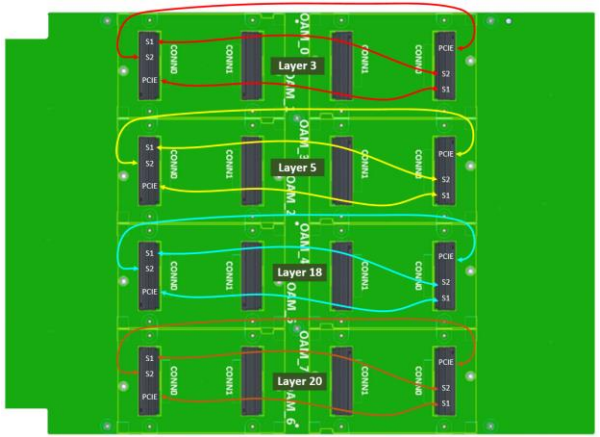


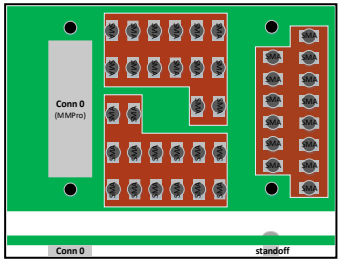
Loss budget at 28GHz						
SMA*2	**Mirror Mezz Pro*2**	**UBB trace loss(EM892K)**	**UBB via*2**	**OAM trace loss(EM892K)*2**	**OAM via*2**	**Total channel**
0.25/pcs	0.25/pcs	13dB for 15.2" trace (0.855dB/inch)	0.5dB/per via	6.85dB for 8" trace (0.855dB/inch)	0.7 (SMA via + conn via)	
0.25*2=0.5dB	0.25*2 = 0.5dB	13dB	0.5*2=1dB	6.85*2=13.7dB	0.7*2=1.4dB	**30dB**

112G PAM4 Test Fixture

	Port	OAM Layer	OAM Length (inch)	MMPro Loss (dB)	SMA Loss (dB)	OAM Via Loss (dB)	OAM Loss (dB)	UBB Lenght (inch)	UBB Length Loss (dB)	UBB Via Loss (dB)	UBB Total Loss (dB)	UBB Layer	OAM Length (inch)	MMPro Loss (dB)	SMA Loss (dB)	OAM Via Loss (dB)	OAM Loss (dB)	OAM Layer	Port	
OAM1	S1_RX[12]	L5	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L3	7.99	0.21	0.25	0.71	8	L9	S2_RX[8]	OAM0
	S2_RX[8]	L9	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L3	7.99	0.21	0.25	0.71	8	L26	PCIE_RX[8]	
	PCIE_RX[8]	L26	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L3	7.99	0.21	0.25	0.71	8	L5	S1_RX[12]	
OAM2	S1_RX[12]	L5	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L5	7.99	0.21	0.25	0.71	8	L9	S2_RX[8]	OAM3
	S2_RX[8]	L9	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L5	7.99	0.21	0.25	0.71	8	L26	PCIE_RX[8]	
	PCIE_RX[8]	L26	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L5	7.99	0.21	0.25	0.71	8	L5	S1_RX[12]	
OAM5	S1_RX[12]	L5	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L9	S2_RX[8]	OAM4
	S2_RX[8]	L9	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L26	PCIE_RX[8]	
	PCIE_RX[8]	L26	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L5	S1_RX[12]	
OAM6	S1_RX[12]	L5	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L9	S2_RX[8]	OAM7
	S2_RX[8]	L9	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L26	PCIE_RX[8]	
	PCIE_RX[8]	L26	7.99	0.21	0.25	0.71	8	15.20	13.00	1.00	14.00	L20	7.99	0.21	0.25	0.71	8	L5	S1_RX[12]	







OPEN ACCELERATOR INFRASTRUCTURE

OPEN POSSIBILITIES.

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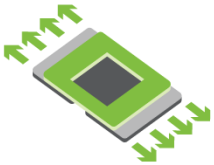
PCB Material



OPEN ACCELERATOR INFRASTRUCTURE

UBB v1.0 Reference Design – Ultra Low Loss Material

- @14GHz (loss/inch): **~0.88dB**

UBB v1.5 Reference Design – Hyper/Extreme Low Loss Material

- @28GHz (loss/inch): **0.73 – 0.92dB**

Material	Stack up (Core/PP)	Loss @28GHz	UBB Length (Inch)
Vendor A	4/5	0.92	14.2
Vendor A	5/6	0.73	17.8
Vendor B	4/5	0.85	15.3
Vendor B	5/6	0.78	16.7

Test System Stack Up

GCE proposal						
GCE stackup	Thickness	Copper/Glass type	Oxide Treatment Chemical	ASSUMED Copper rate	Supplier Dk	Supplier Df
	(mil)				1 GHz	1 GHz
solder mask	1.00					
0.5 oz+plating	2.10	STD H.T.E				
1078 65% x 1	2.68				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
1078 67% x 4	11.44				2.96	0.0010
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.001
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
1078 65% x 2	4.96				2.99	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
1078 65% x 2	4.96				2.99	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
1078 65% x 2	4.96				2.99	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
1078 65% x 2	4.96				2.99	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.001
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
1078 65% x 1	2.68				2.99	0.001
0.5 oz+plating	2.10	STD H.T.E				
solder mask	1.00					
total=	128.39	(w/o S/M)				
	mils					

22 Layers
128.39 mils Thickness

GCE proposal						
GCE stackup	Thickness	Copper/Glass type	Oxide Treatment Chemical	ASSUMED Copper rate	Supplier Dk	Supplier Df
	(mil)				1 GHz	1 GHz
solder mask	1.00					
0.5 oz+plating	2.10	STD H.T.E				
1078 65% x 1	2.68				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
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1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
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1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
1035 77% x 2	4.56				2.85	0.0009
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
1035 77% x 2	4.82				2.85	0.0009
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
5.5 mils core	5.50	1078 59.5% x 2			3.05	0.0010
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
1035 77% x 2	4.82				2.85	0.0009
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
1035 77% x 2	4.56				2.85	0.0009
2.0 oz	2.61	RTF	BONDFILM MS 100	80%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
1.0 oz	1.25	RTF	BONDFILM MS 100	80%		
1078 65% x 2	4.96				2.99	0.0010
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	40%		
4.0 mils core	4.00	1035 66% x 2			2.98	0.0010
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1078 65% x 2	4.96				2.99	0.0010
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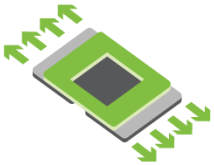
1.0 oz	1.25	HVLP 4	BONDFILM HF 1000	80%		
1078 65% x 1	2.68				2.99	0.0010
0.5 oz+plating	2.10	STD H.T.E				
solder mask	1.00					
total=	162.14	(w/o S/M)				
	mils					

28 Layers
PCB Thickness: 162.14 mils

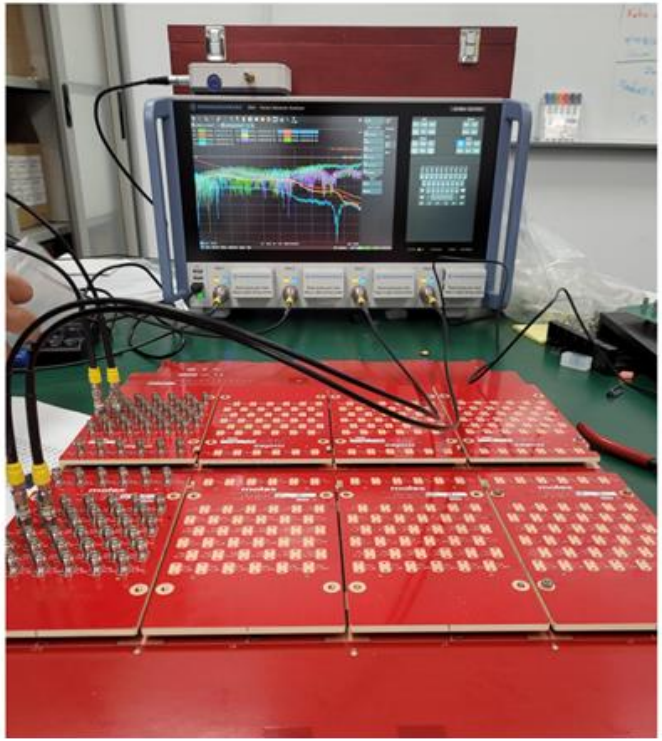
OAM v1.5 112G Channel Demo



OPEN ACCELERATOR INFRASTRUCTURE

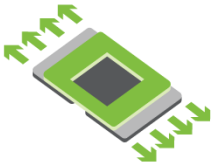
Demo video of validation for this fixture design

[Channel Test Video]



Availability Details

Item	Availability
Mirror Mezz Pro Connector	5mm: Tooled/Available Part Number: 218910-1115 8mm: November 2021
OAM Test Vehicle	November 2021
Connector CTV	92Ohm: November 2021 85Ohm: December 2021



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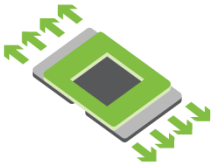
Mirror Mezz Pro



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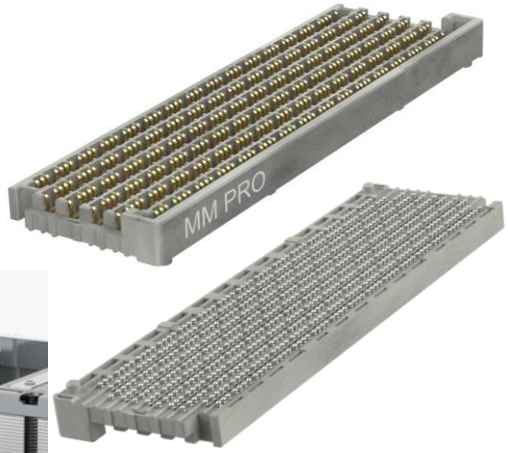
Next generation Mirror Mezz capable of performance up to 112G

- Optimized BGA size to minimize RL impact
- Terminal tuned to minimize RL impact and reduce impedance variation

Highest density (107-115 DP/in^2), same pin mapping, footprint, and mechanical requirements as original Mirror Mezz

Color difference to distinguish between two connector generations



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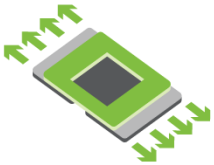
Mezzanine Connector

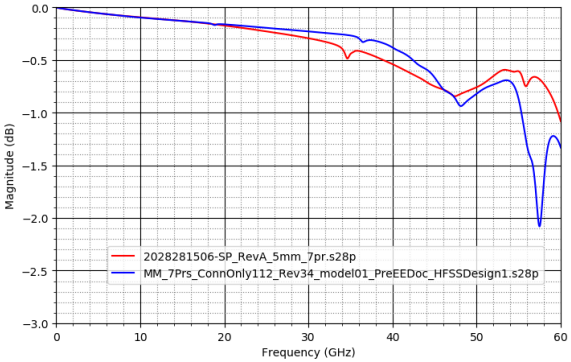
OAM/UBB v1.0 – Molex Mirror Mezz

OAM/UBB v1.5 – Molex Mirror Mezz Pro

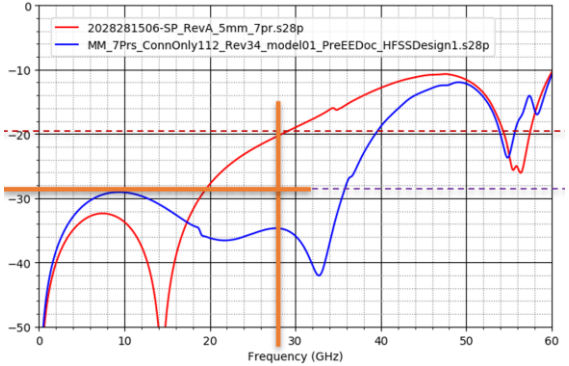


OPEN ACCELERATOR INFRASTRUCTURE

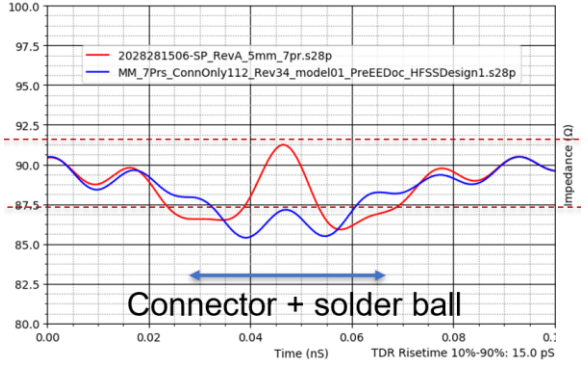
IL



RL



TDR



OPEN POSSIBILITIES.

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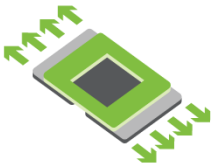
Mezzanine: Simulated Connector Only



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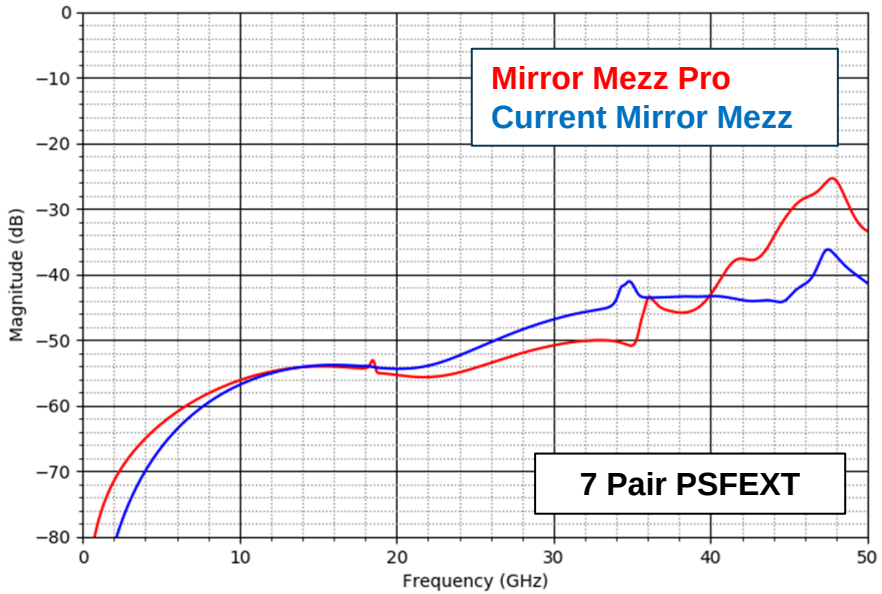
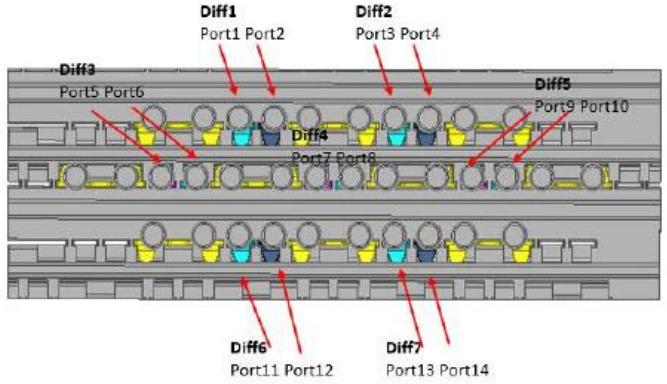


Condition	FEXT ICN
Nominal	0.86mv
MM pro	0.70mv



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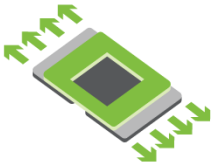
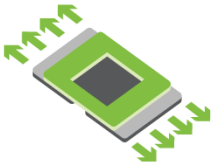
High Speed Workstream Channel Development Team



OPEN ACCELERATOR INFRASTRUCTURE

- Inspur: UBB layout
- Wiwynn: SMT assembly, UBB layout
- Intel: System architect/project lead
- Molex: OAM layout, connector design, test system performance validation
- EMC: Material provision
- GCE: PCB Fab

Call to Action



OPEN ACCELERATOR INFRASTRUCTURE

Get involved in the project:

OCP Server Project: https://www.opencompute.org/projects/server

OAI Subgroup: https://www.opencompute.org/wiki/server/OAI

OAI Mailing List: https://oc-all.goup.io/g/OCP-OAI

OPEN POSSIBILITIES.

OCP GLOBAL SUMMIT

NOVEMBER 9-10, 2021

Thank you!