CDRD Project Meeting
ATx Development Report

19 Oct, 2012

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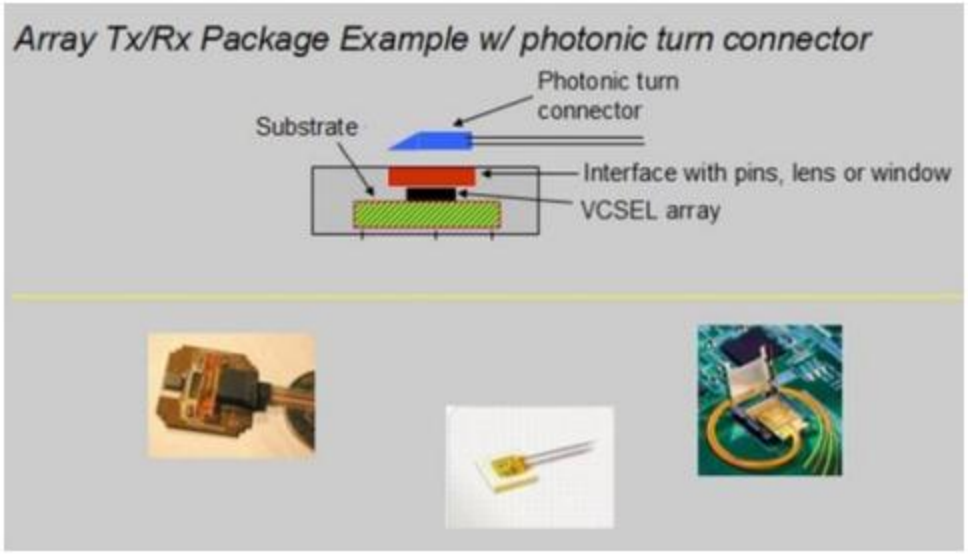
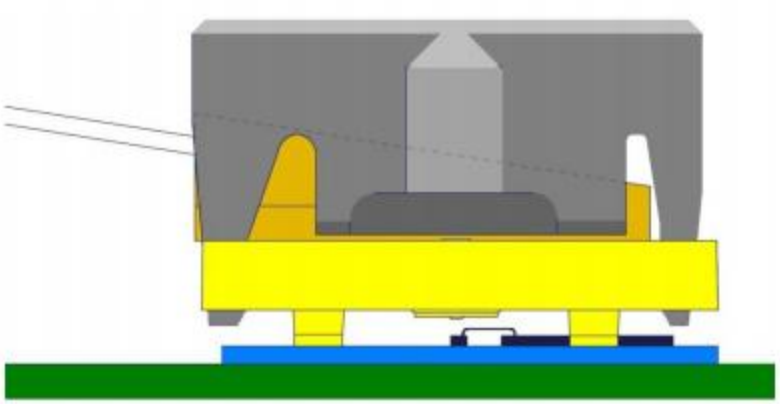
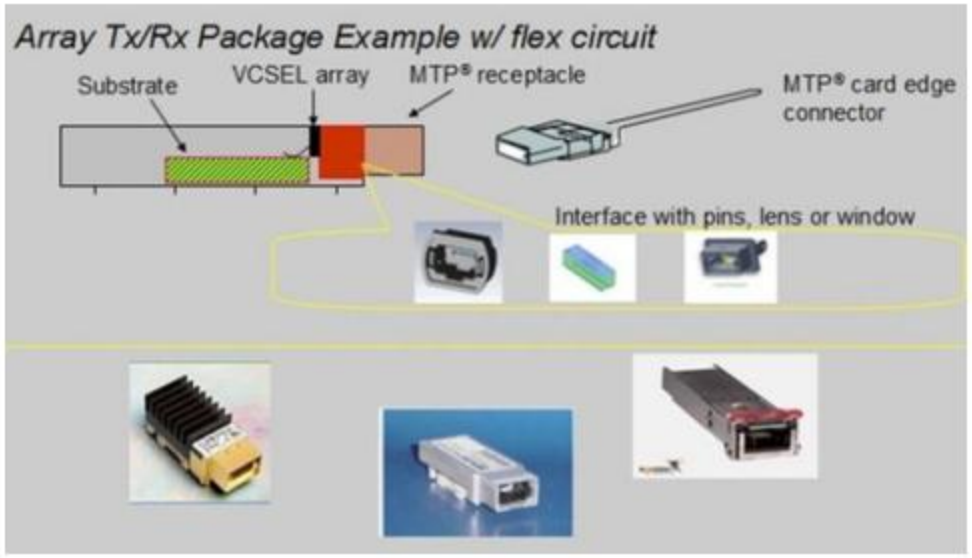
ATx Module Concepts – MiniPOD Adaptation

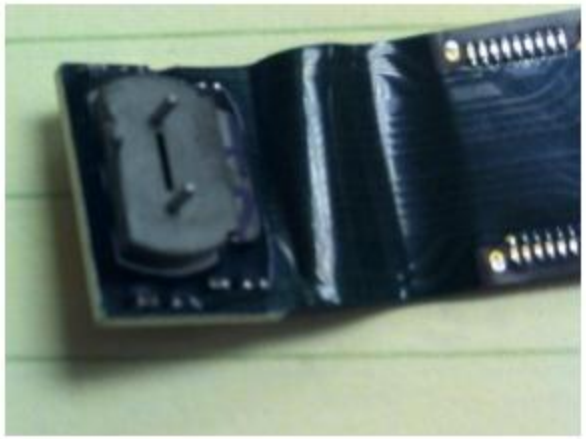


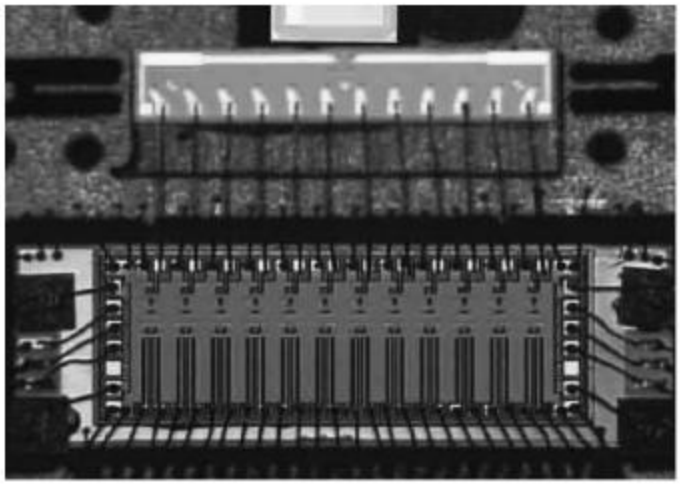


- mid-board module adaptation
- Optical interface (MOI) with photonic turn connector (Prizm)
- Usconec provides the parts with limited design support

ATx Module Concepts – QSFP Adaptation







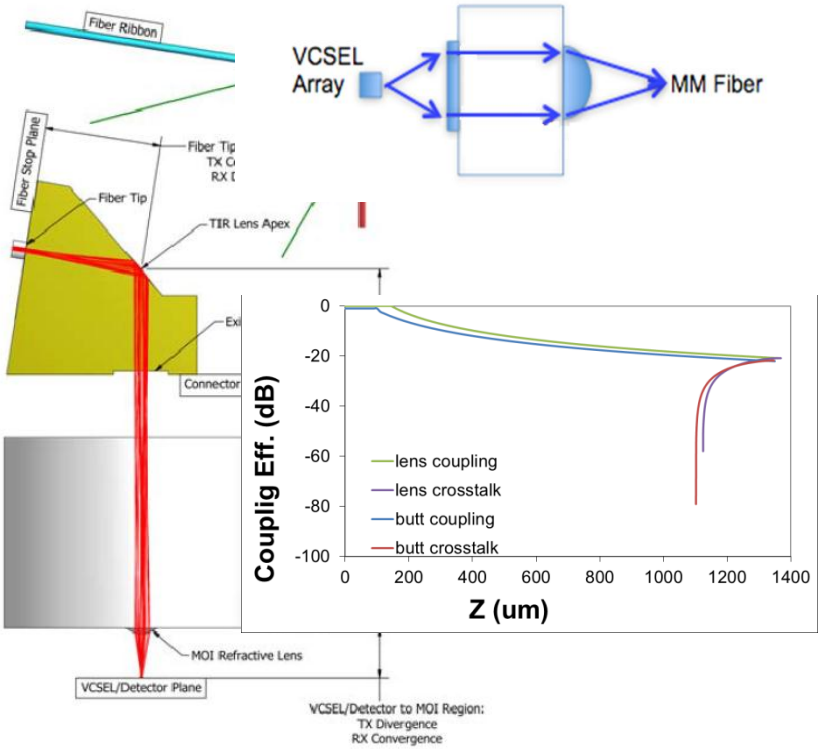
- QSFP module adaptation
- Lens array holder with flex PCB
- Usconec provides the parts with limited design support

Module Components

- ASICs
  - Will use COTS for first prototype
  - Iptronics and Gigopitx EVMs fabed
  - SMU LOCld1/4 EVMs designed
  - Would like to discuss with OSU
- VCSEL Arrays
  - ULM and Finisar arrays procured
- Mirco optics
  - MOI and lens holder assembly procured

Optics Evaluation

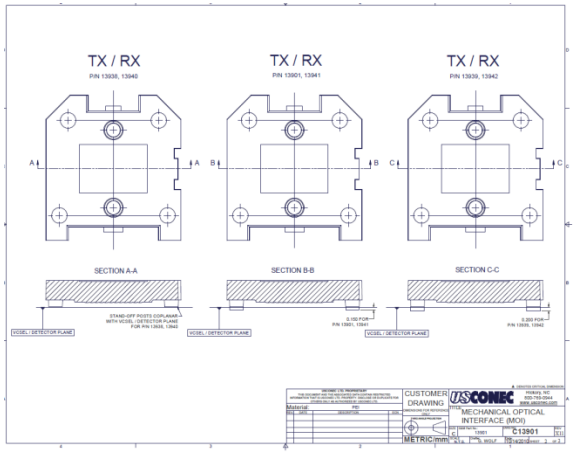
- Only optical plane dimensions are provided
- Tolerance data based on normalized coupling efficiency (instead of absolute insertion loss)
- We are in pursuit with more detailed micro lens parameters; the assumed simulation results are reasonably close to the vendor provide specification.



coupling scheme	-1dB insLoss		-3dB insLoss	
	lateral	axial	lateral	axial
butt-coupling	10um	90um	21um	126um
microlens array	14um	110um	24um	150um

Optical Evaluation

- Both butt-coupling and lens coupling are reasonably tolerant to lateral and axial alignment, with minimal cross talk impact.
- Butt coupling was used years ago with uniferrule. Module makers have moved to lensed based interface for packaging concerns.
- Also as data rates and power level increase, the VSCEL divergence angle may start to cause problems in a butt couple.



2. Restricted Launch

VCSEL positioning tolerances for Restricted Mode Launch, 2000 MHz-km (IEEE 802.3ae), 86% encircled flux within 19 µm radius and less than 30% within 4.5 µm radius measured according to TIA 455-203. Coupling efficiency within specification. It is expected that 90% of all subassembly-lens-fiber systems is within coupling efficiency specification if all 12 channels are within 3-sigma tolerances below.

Parameter		Unit	
Lateral Tolerance X	±7	µm	
Lateral Tolerance Y	±7	µm	
Longitudinal Tolerance	±40	µm	
Pitch Tolerance (Y rot)	±1	°	
Roll Tolerance (X rot)	±1	°	

Assumptions:

1. VCSEL APERTURE 13 µm MAX
2. BEAM DIVERGENCE 16-32 deg.

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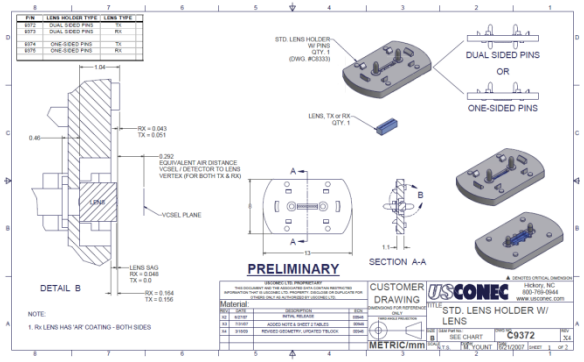
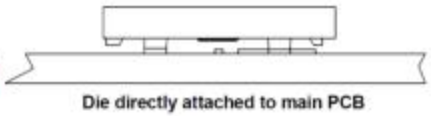


Process Evaluation

- The following process options are been discussed with assembly vendors
- Die on PCB – difficult due to surface smoothness
- Ceramic substrate -- substrate can be too thin to be stressed by PCB flexure
- Ceramic interposer – complex but reduced strain through ball bumps
- FPC with stiffener and cutout -- fiducial and pattern needed for precision placement

- These design objectives are to be evaluated with the prototypes
- The construct accommodates 10Gbps signal integrity
- There is no significant change in intrinsic attenuation under irradiation
- Reasonable hermasticity under humid condition
- Sufficient thermal conductivity for a compact 1W/unit power dissipation and for stable optoelectronics performance

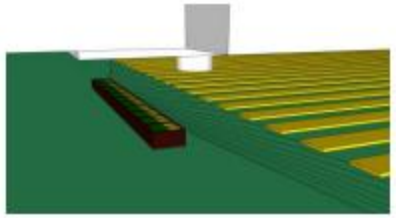


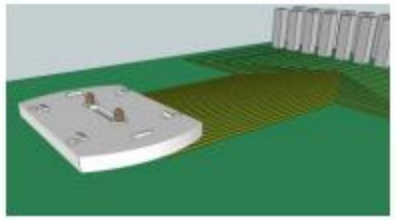
Die directly attached to main PCB

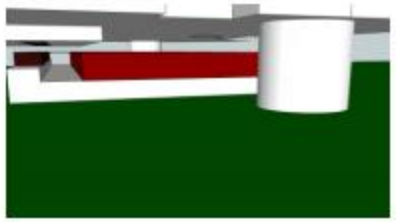
Die attached to ceramic/organic interposer that is directly attached to main PCB

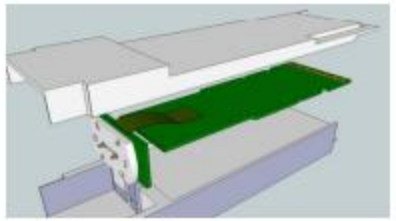
Die attached to ceramic/organic interposer that is indirectly attached to main PCB by way of ball bumps

Die attached to ALN stiffner and wire bonded to flex PCB with precision cut outs









COTS tests

- QSFP, miniPOD, PPOD, ONET8501V, ONET1101L have been tested with x-ray or gamma rays. None of them meet the ATLAS LAr radiation requirement.
- A neutron beam have been booked at Los Alamos in October. Kintex 7, PPOD, ONET8501, will be tested. A proton test will be done in December.

	Vendor	Part#	Data rate (gbps)	# of ch	Rad type	Dose rate (krad/hr)	Total dose (krad)
QSFP	Avago	AFBR-79EIDZ	10	4	^{60}Co γ	10	75
miniPOD	Avago	AFBR-810FN1Z	10	1	x-ray	360	66
PPOD	Avago	AFBR-810EPZ	10	12	x-ray	360	150
VCSEL driver	TI	ONET8501V	10	1	x-ray	39	178
F-P laser driver	TI	ONET1101L	10	1	x-ray	9.6	464
					^{60}Co γ	10	< 900