# DUNE Cryogenic Optical Links

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# Introduction

Initial testing has so far failed to produce an SFP+ module (either Tx channel or Rx channel) that functions suitably when tested in LN2.

There is some indication that electronic issues are behind at least some of the failures.

Therefore, we propose to construct test hardware with selected components to try to identify the sources of failures and to identify suitable components out of which a custom CryoLink component might be produced.

FNAL will start with DFB-equipped TOSAs (modules with these performed best last week) and laser drivers suitable for driving those TOSAs.

We are working with Southern Methodist University (Versatile Link partners) who add valued knowledge and experience in this effort.

GBLD:
GigaBit Laser Driver

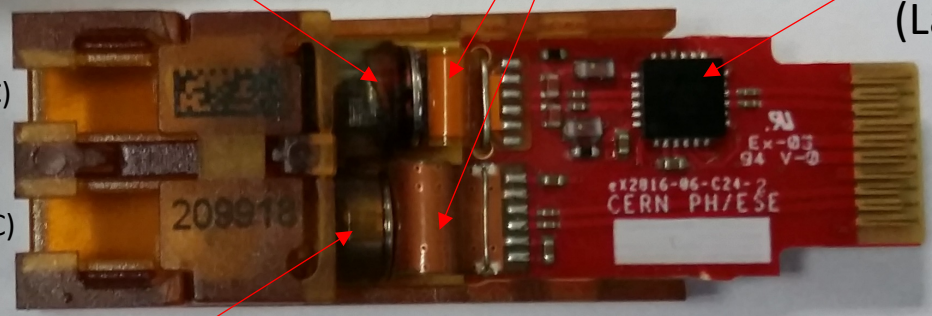
GBTIA:
GigaBit TransImpedance Amplifier

TOSA:
Transmitter Optical SubAssembly

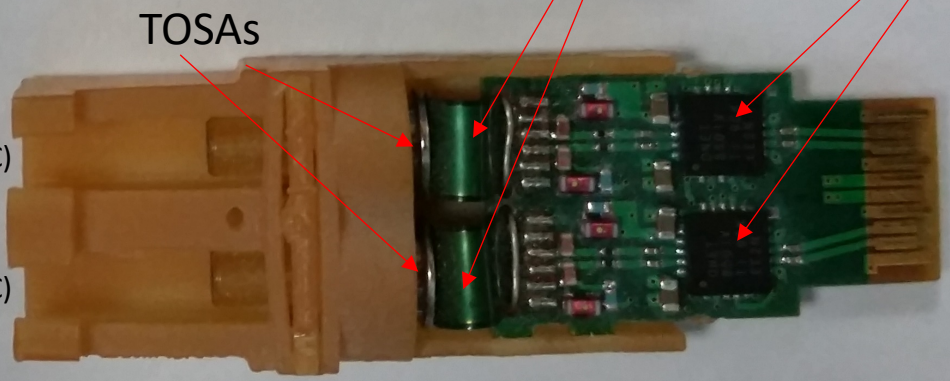
ROSA:
Receiver Optical SubAssembly

COTS SFP+

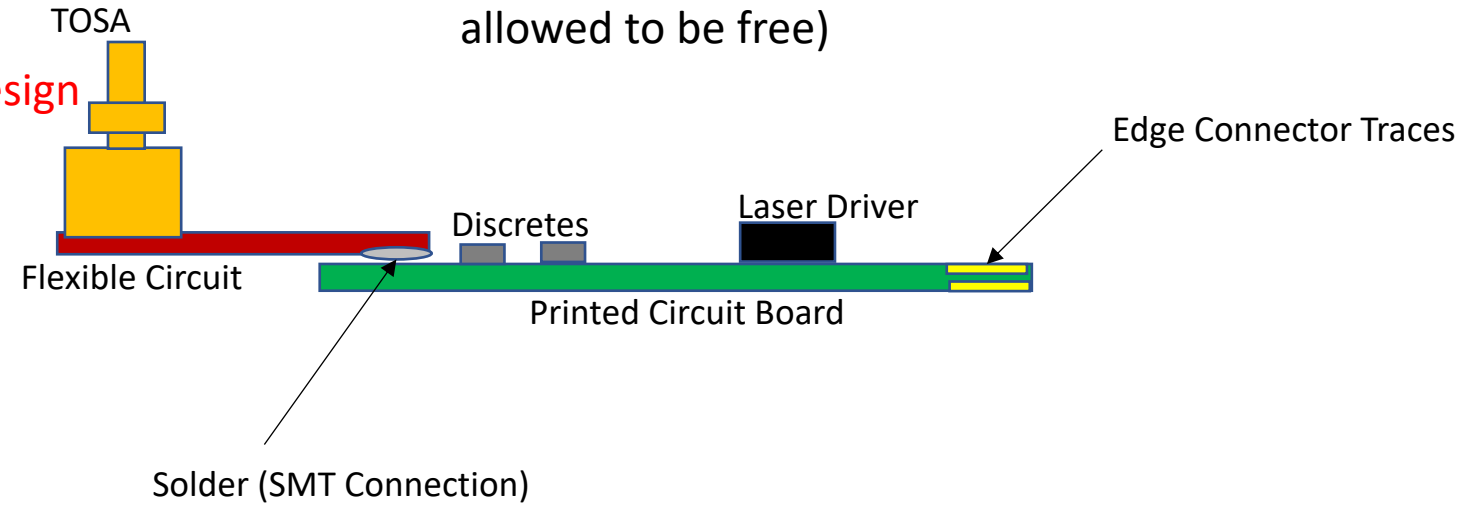

Versatile Link VTRx Transceiver




Versatile Link VTTx Twin Transmitter

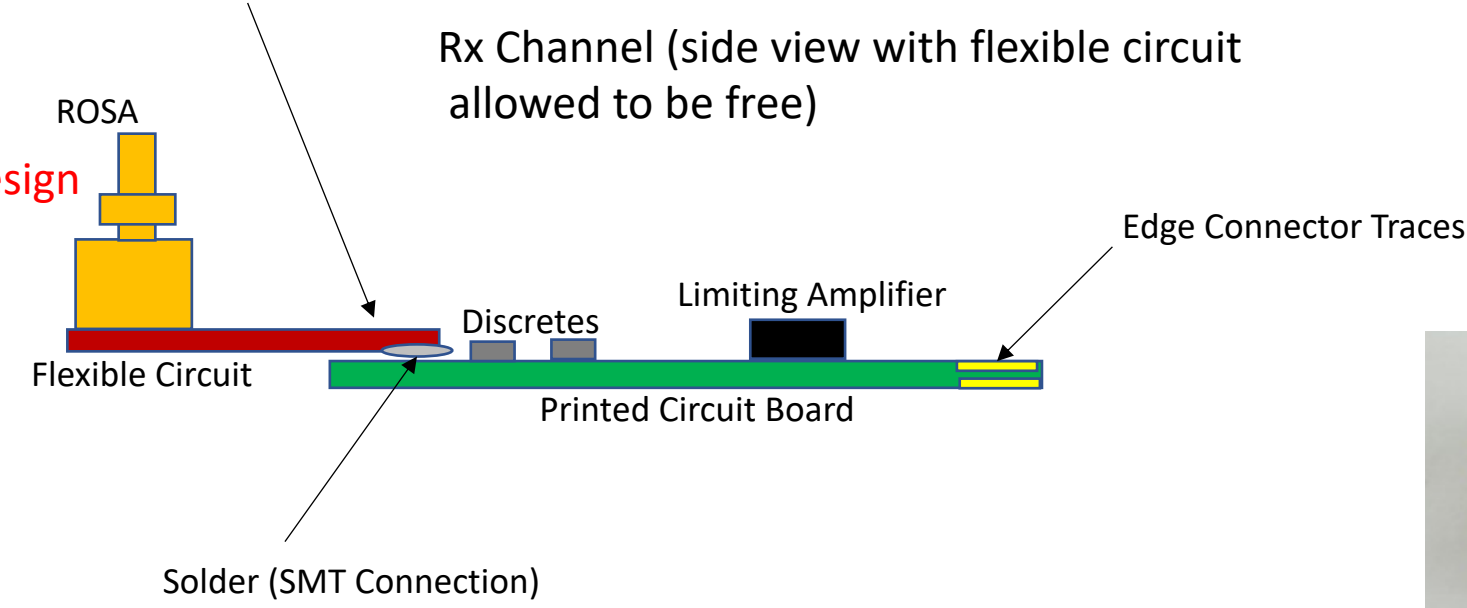


Tx Channel (side view with flexible circuit allowed to be free)

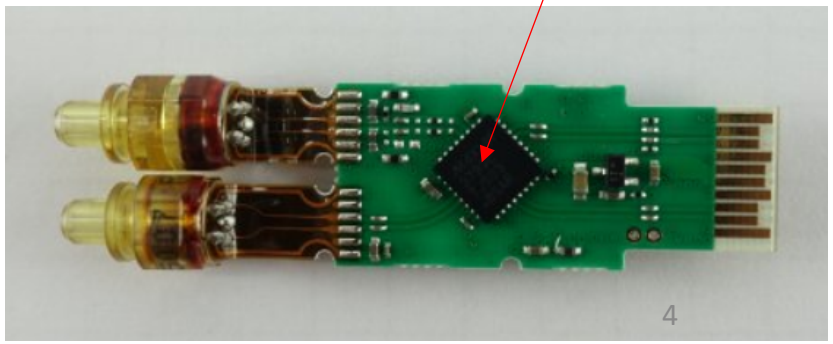



Strain relief for flexible circuit on each channel?

Rx Channel (side view with flexible circuit allowed to be free)




MicroController Unit (MCU)



# Simple Evaluation Board for Analog Devices ADN2526 Laser Diode Driver
## Electrical Tests

All components will be tested in LN2.

Power, configuration, electrical excitation, and electrical diagnostics will be outside the dewar

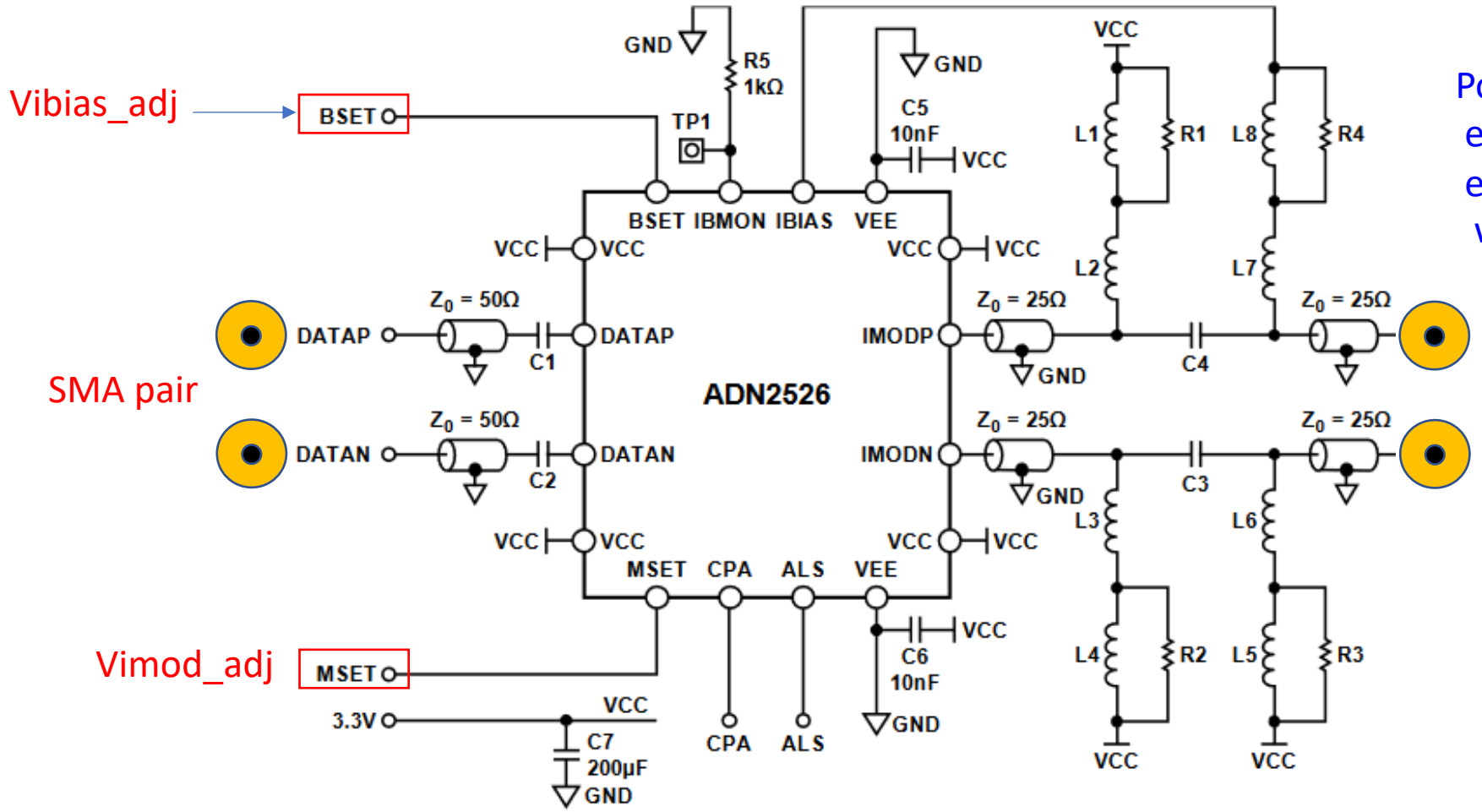



*Figure 34. Typical Application Circuit*

Leave Cross Point Adjust and Automatic Laser Shutdown unconnected (50% cross point, laser enabled)

# Simple Evaluation Board for Analog Devices ADN2526 Laser Diode Driver
## Optical Tests

All components will be tested in LN2.

Power, configuration, electrical excitation, and optical receiver will be outside the dewar

TOSA Coupled to Single Mode Fiber or MultiMode Fiber

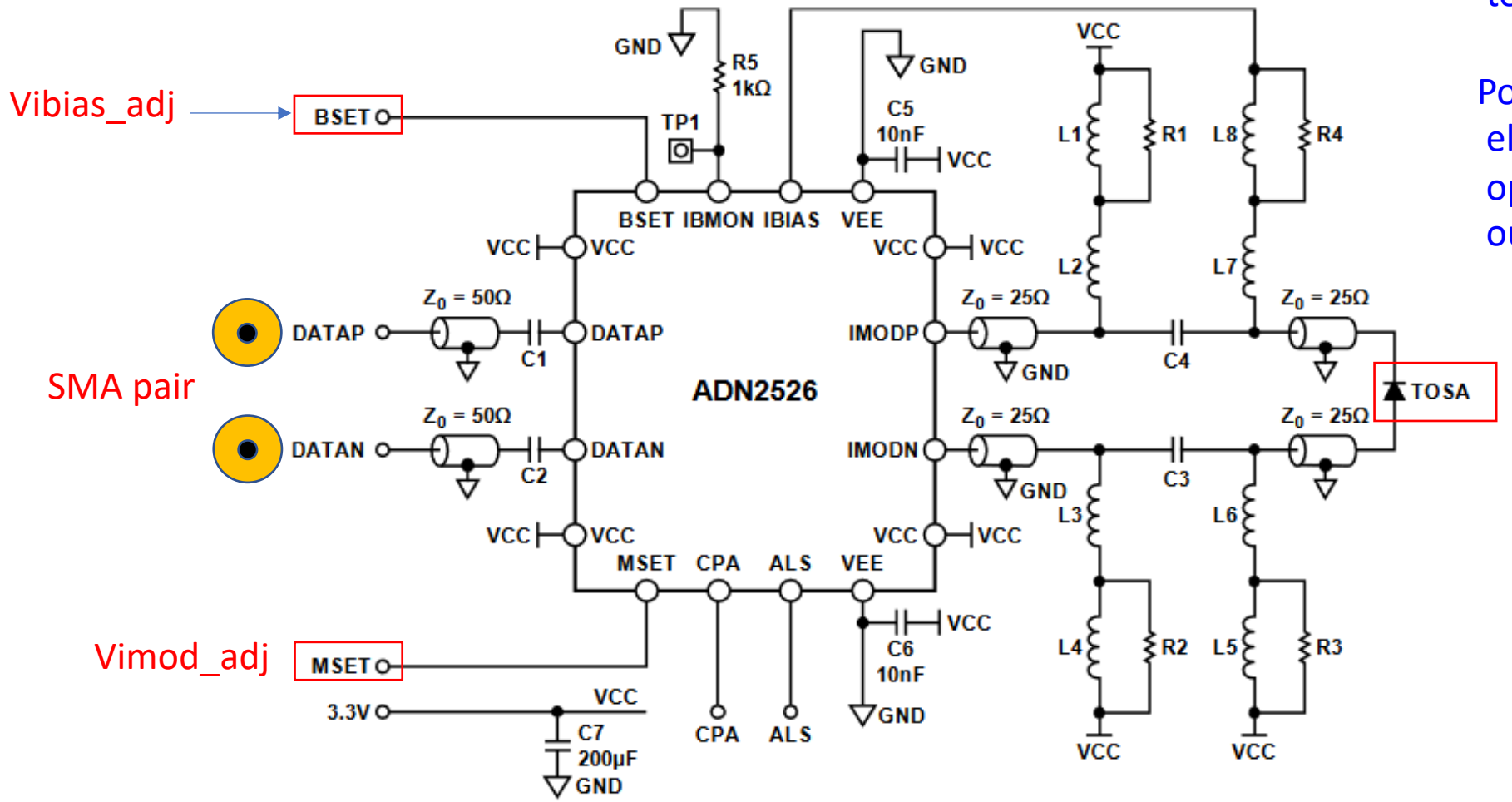



*Figure 34. Typical Application Circuit*

Leave Cross Point Adjust and Automatic Laser Shutdown unconnected (50% cross point, laser enabled)

# Texas Instruments ONET1151L Laser Diode Driver

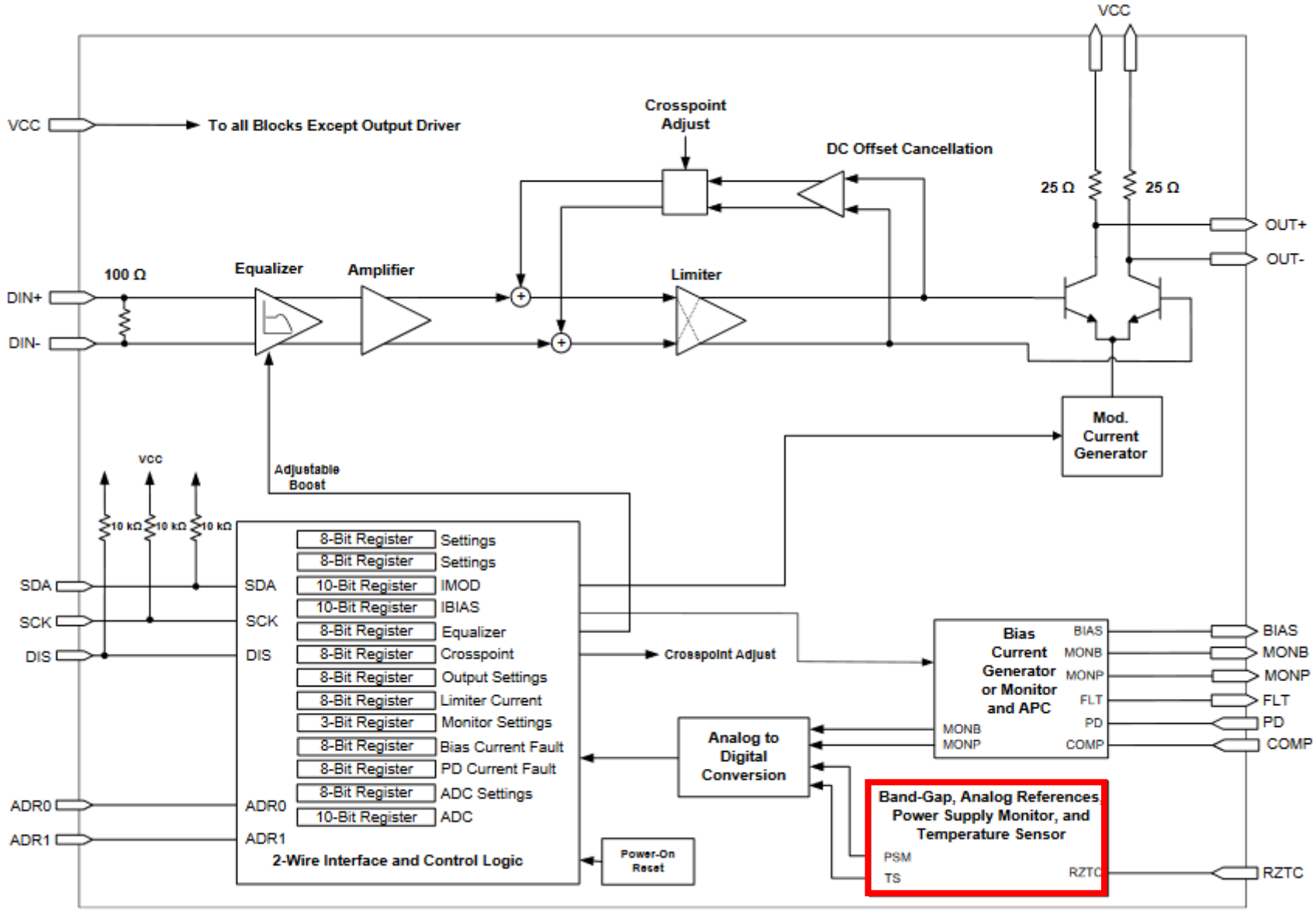



**Figure 1. Simplified Block Diagram of the ONET1151L**

# Texas Instruments ONET1151L PAB Test Circuit Proposal (Stage 1)
# Optical Tests

Interface To I2C Dongle Outside Dewar

SMA pair

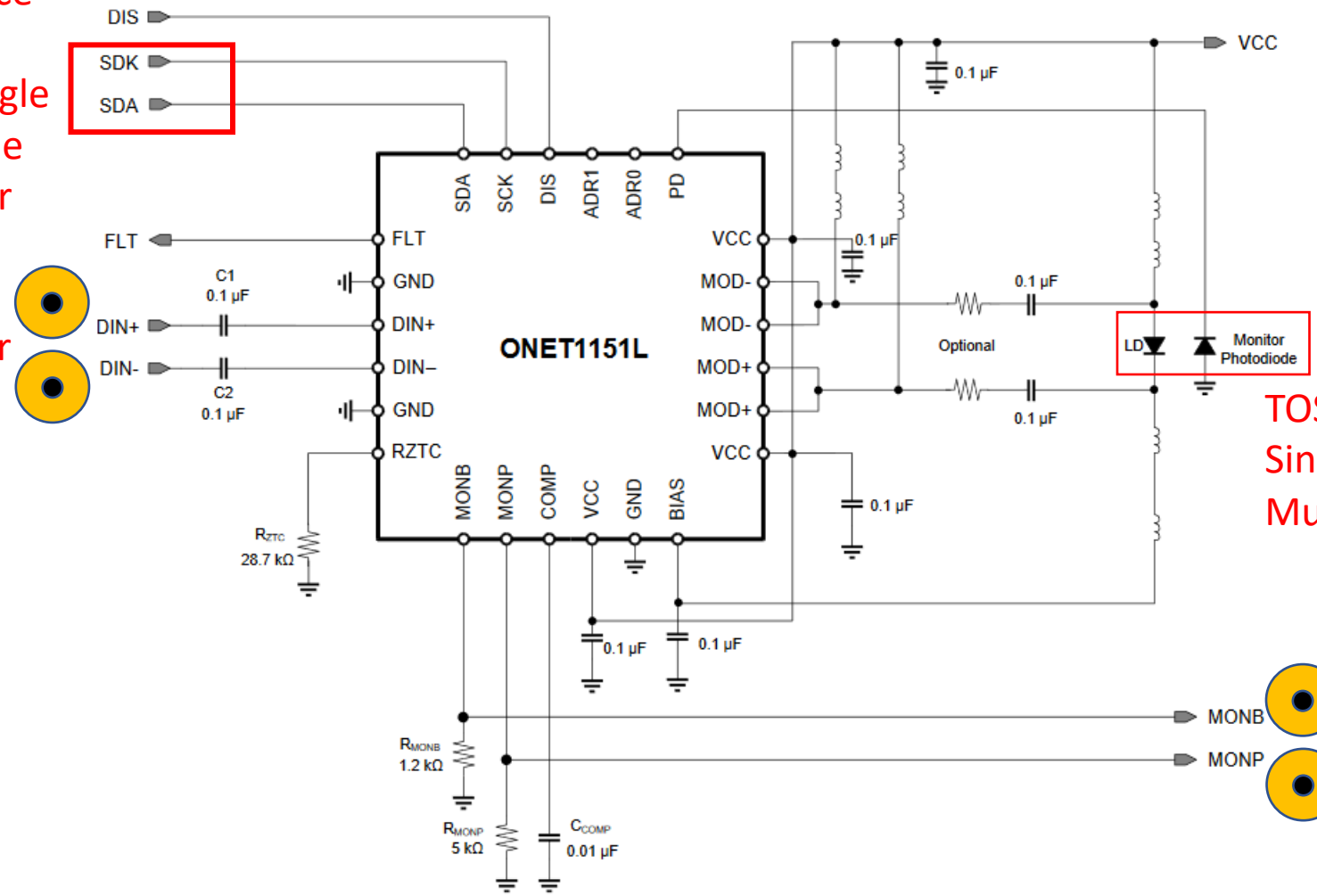



**Figure 20. AC-Coupled Differential Drive**

All components will be tested in LN2.

Power, configuration (I2C dongle), electrical excitation, electrical monitoring, and optical receiver will be outside the dewar

TOSA Coupled to Single Mode Fiber or MultiMode Fiber

SMA

SMA

Leave DIS unconnected (laser enabled)

# Texas Instruments ONET1151L PAB Test Circuit Proposal (Stage 2)

Interface To CryoFPGA

SMA pair

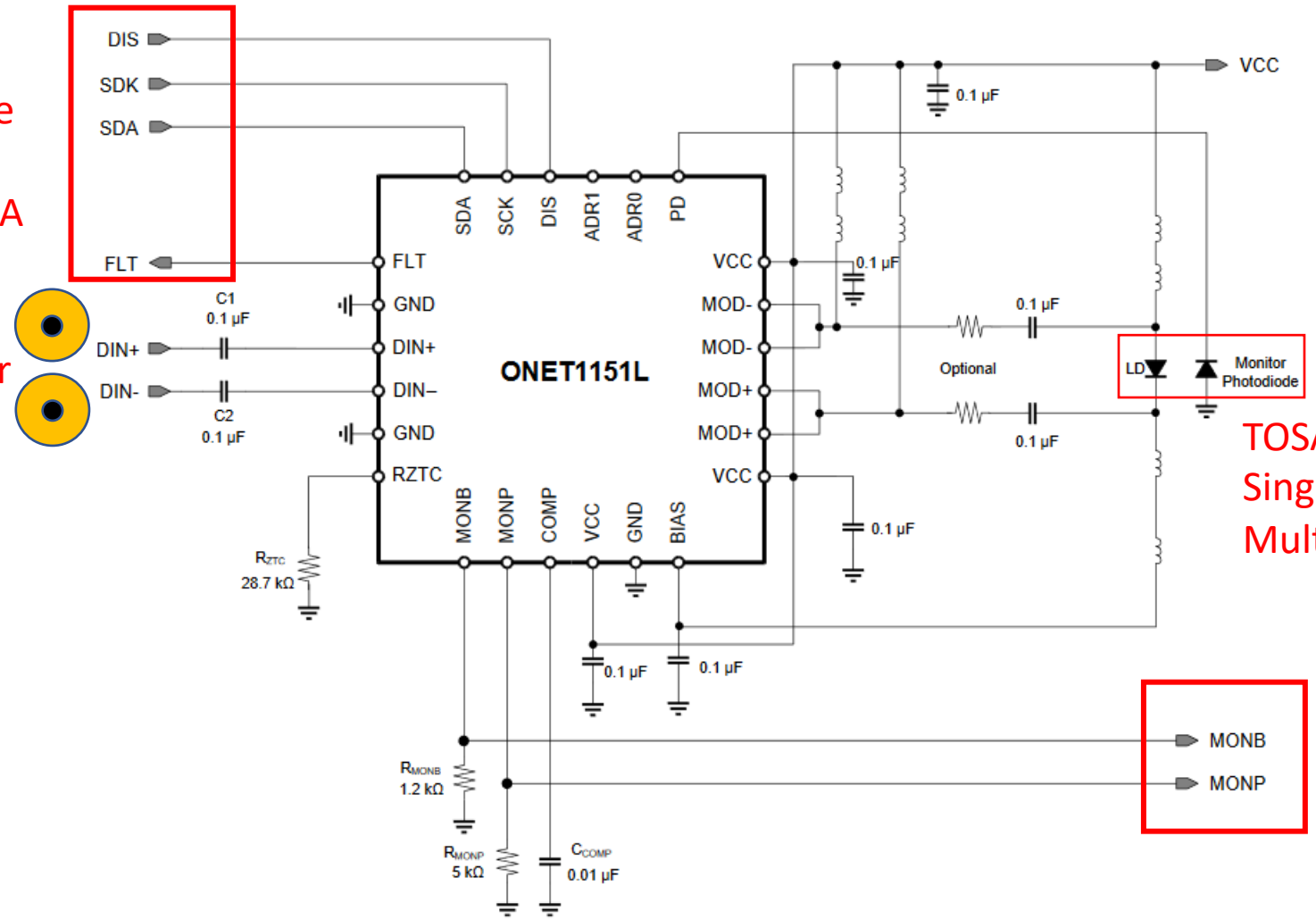



**Figure 20. AC-Coupled Differential Drive**

All components will be tested in LN2.

Power, electrical excitation, and and optical receiver will be outside the dewar. FPGA to configure laser driver will be in the dewar.

TOSA Coupled to Single Mode Fiber or MultiMode Fiber

Interface To CryoFPGA

# Summary

FNAL and SMU will jointly investigate technologies out of which suitable CryoLink (CL) transmitter and receiver channels may be developed.

SMU will test TOSAs and ROSAs (including VCSEL-based TOSAs).

SMU has earlier experience with LOCld (custom laser driver) and Cyclone III FPGA in LN2.

FNAL and SMU will jointly develop custom CL Tx/Rx as necessary (if COTS modules cannot be verified in LN2).