

Optical transceiver in miniature form factor for radiation hazard applications

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Optical transceiver provides high speed data transmission using low mass fibers over a long distance in applications of detector readout. A miniature form factor is favorable for compactness in detector design. We report on a chip-on-board transceiver assembly of 2 mm in height, with bare-die opto-electronics and driver ASICs of 10 Gbps aligned within a light coupling prism. The active opto-electronics of 850 nm VCSEL and PIN diodes are commercial products being evaluated for radiation tolerance to the order of 1×10^{15} (1 MeV) n/cm². New driver ASICs are developed for radiation hardness in TSMC 65 nm technology. The light coupling prism made of Polyether Imide (PEI) shows negligible attenuation after being irradiated by Co⁶⁰ gamma-ray to 100 kGy. The alignment of VCSELs and PINs to the prism lenses is fabricated in an automatic assembly of better than 5 μm precision and the fixture is adhered by fast cure epoxy. Light coupling efficiency is investigated for the VCSEL light emission modes in far field angle and the temperature dependence. Ageing effects are investigated in 85°C, 85% RH burn-in tests for the assemblies and the VCSELs characteristics to more than 3000 hours. The ageing effects vary between VCSELs of different manufacturers. With qualified electronic components, the assembly will sustain applications in a radiation hazard environment.

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