Multimode Fiber Connector for Automotive Applications

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Modified “MOST” ferrule for high-bandwidth MMF

Enables continued utilization of:
- Current manufacturing equipment, e.g., Laser welding
- Automated component placement
- Inline connector adapters
- Equipment termini

Familiarity:
- Same MOST fit and form factor
- Used by automotive harness manufacturers
- Automotive mechanics in dealerships
- No training required
- Ease of cleaning (wipe with clean cloth)

Differentiation:
- Ultra-low cost
- 2 molded plastic parts (lens & ferrule) + assembly
- Option for index matching gel (0.5 dB reduction in IL)
Expanded beam connector

- MOST Ferrule form factor
- POF Jacket material
- C-Lens
MOST Connector Components
Gen I Lens – Polycarbonate

- Capture cone for precise fiber to lens alignment
- Can be modified for any fiber dimension
Component Assembly
Laser welding

- Harness maker requested laser welding for ferrule attachment
- A laser is used to melt the buffer material with the ferrule material
- In order to reach a high absorbance at the buffer material, carbon particles are blended in when the buffer is extruded
- Transparency of the ferrule must be highly homogeneous
Mated ferrules
Gen I Optical System Modeling

- Polycarbonate lens
- No index matching gel at fiber/lens interface
- Absorption due to polycarbonate lenses at 850 nm = 2x 0.34dB
Loss vs angle for separation: 2, 9, 16 mm

Loss, (dB)

Angle, (deg)

No Gel (0.2 dB x2)
No absorption
Sensitivity to Lateral misalignment with lens thickness (at optimum radius of curvature)

\[ n = 1.5688, \ R = 1.303 \]

[Diagram showing loss as a function of lateral offset with different curves for different lens thicknesses and curvature radii, along with labels for scenarios where there is no gel and no absorption.]
Sensitivity to Radius of curvature

At 10 mm for n=1.5688
Launch fiber to receive fiber separation IL

Lens Separation

Coupling Loss (dB)

Lens Separation, (mm)

No Gel

"1.254, -10um Z"
"1.258, -10um Z"
"1.254, 5 um Y"
"1.258, 5 um Y"
"1.27 no offsets"
Loss Measurements Gen I Lens

Loss vs distance lens to lens

Loss vs angle

- Machined lens
- Commercial lens
Gen II Lens – new material system

- Negligible material attenuation at 850 nm
  - Absorption due to polycarbonate lenses = 2x 0.34dB

- Relative temperature index 170 °C

- Presently modeling optimum lens parameters (RC, L, Dia.)

- Fresnel Reflection (lens to air) = 0.237 dB

- Objective: 1.5 dB max. IL with no AR coating

- 4 connector pairs, worst-case IL = 6 dB
Questions