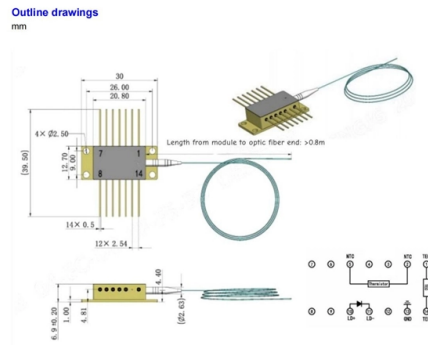


Optical Module Coupling Process Steps



Overview

Introduction To The COB Process For Optical ModulesThe COB process mainly consists of three key steps: die bonding, wire bonding, and optical coupling. 2.1.

Key Takeaways

The optical module coupling process involves die bonding, wire bonding, and precise optical lens alignment to ensure efficient light transmission and reception.Step 1: Die Bonding

Die bonding is the first critical step in optical module assembly. Bare optical and electrical chips are attached to the PCB using conductive silver adhesive. High-precision die bonding equipment identifies the designated positions on the PCB, dispenses the adhesive, and places the chips accurately. After manual inspection, the chips are permanently secured through high-temperature baking to ensure mechanical stability and electrical connectivity .

Step 2: Wire Bonding

Wire bonding connects the electrical chips to optical chips and PCB pads using fine gold wires. This step ensures both electrical and mechanical connections. Wire length and tensile strength are strictly controlled, as improper bonding can degrade module performance, affecting sensitivity and signal quality. Wire bonding defects are a common cause of optical module failures, making this step crucial for reliability .

Step 3: Optical Coupling

Optical coupling aligns a precision lens with the VCSEL or photodetector to maximize light transmission and reception. The process typically involves:

- Loading the PCB with bonded dies into an automatic coupling machine.
- Adjusting the lens position to optimize optical efficiency.
- Temporarily fixing the lens with UV adhesive.
- Permanently curing the lens with black adhesive through high-temperature baking. This automated process improves manufacturing efficiency while maintaining high alignment accuracy. Misalignment or improper adhesive application can lead to variations in output optical power and receiver sensitivity .

Step 4: Lensed Fiber Coupling (Optional)

For modules using lensed fibers, the taper angle and curvature radius of the fiber are adjusted to optimize coupling efficiency. Ground-cone lensed fibers (GCLF) generally achieve higher efficiency and alignment tolerance compared to fused-cone lensed fibers (FCLF). Horizontal and vertical alignment tolerances are carefully controlled to maintain consistent optical performance .

Key Considerations

- Adhesive quality and curing: Ensures mechanical stability and optical alignment.
- Lens alignment precision: Critical for maximizing light coupling efficiency.
- Automated vs. manual processes: Automation improves throughput and consistency.
- Coupling efficiency optimization: Adjusting fiber or lens parameters can significantly impact module performance . This process flow is widely used in the manufacturing of optical transceivers, including TOSA/ROSA assemblies, and is essential for achieving high-performance, reliable optical communication modules .

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