221 through bonding wires, thereby realizing the electrical connection from the photodetector chips 232 to the rigid circuit board 221. The avoidance hole 224 may be a square through hole in the rigid circuit board 221, or a U-shaped through hole at the end portions or lateral sides of the rigid circuit board 211. In other embodiments, the photodetector chips and the transimpedance amplifier can also be disposed on a position outside the rigid circuit board and adjacent to the edge of the rigid circuit board, or the transimpedance amplifier can also be disposed on the rigid circuit board.

[0046] In optical communications, an optical module has a main heat dissipation housing and a secondary heat dissipation housing (a top surface and a bottom surface specified in the multi-source agreement). In this embodiment, the first housing 211 is the main heat dissipation housing of the optical module, and the second housing 212 is the secondary heat dissipation housing. When the optical module is inserted into the optical cage of the optical communication host, the first housing 211 is adjacent to a heat dissipation mechanism of the optical cage that is the main area for heat dissipation between the optical module and the external environment. The photoelectric chips 230, such as the laser chips 231 and their substrates 236 (COC structures), the photodetector chips 232, etc. and main power consumption chips, such as a transimpedance amplifier and a driver, etc. are arranged on the bottom plate of the first housing 211, and the heat generated during operation can be quickly dissipated directly from the first housing 211, so as to have a more rapid heat dissipation path and faster heat dissipation speed than through the heat sink and heat dissipation paste to the first housing in the conventional technology, thereby effectively improving the heat dissipation performance of the optical module.

[0047] The optical module in this embodiment is a multi-channel optical transceiver module. The optical interface 200b of the housing 210 is provided with a transmitting-end optical receptacle 260a and a receiving-end optical receptacle 260b. The transmitting-end optical processing assembly includes a wavelength division multiplexer 241, and a first collimating lens array (i.e., the first lens group) 271 is provided between the wavelength division multiplexer 241 and the laser chips 231. A first coupling lens group 250a is provided between the wavelength division multiplexer 241 and the transmitting-end optical receptacle 260a. Multiple beams of light emitted by the multiple laser chips 231 are respectively collimated by the respective collimating lens of the first collimating lens array 271, and then incident to the wavelength division multiplexer 241, and are combined into a beam of combined light by the wavelength division multiplexer 241; the beam of combined light is coupled into the transmitting-end optical receptacle 260a through the first coupling lens group 250a, and is transmitted to an external optical fiber through the transmitting-end optical receptacle 260a. The receiving-end optical processing assembly includes a wavelength division demultiplexer 242; a second coupling lens array (i.e., a second lens group) 272 is provided between the wavelength division demultiplexer 242 and the photodetector chips 232, and a second collimating lens group 250b is provided between the wavelength division demultiplexer 242 and the receiving-end optical receptacle 260b; the above-mentioned first coupling lens group 250a and the second collimating lens group 250b constitute a third lens group 250 that is correspondingly located at the ports of the transmitting-end optical receptacle 260a and the receiving-end optical receptacle 260b. After receiving a composite optical signal transmitted

by the external optical fiber, the receiving-end optical receptacle 26b transmits the received composite optical signal to the second collimating lens group 250b; the composite optical signal is collimated by the second collimating lens group 250b and then incidents to the wavelength division demultiplexer 242, and is demultiplexed into multiple single-channel optical signals by the wavelength division demultiplexer 242; each of the single-channel optical signals is coupled to the corresponding photodetector chip 232 through the respective coupling lenses of the second coupling lens array 272; each photodetector chip 232 respectively converts the respective single-channel optical signal into an electrical signal to be transmitted to the transimpedance amplifier 235, and the transimpedance amplifier 235 amplifies each electrical signal that is then transmitted to the rigid circuit board 221 for being signal processed on the rigid circuit board 221 and being uploaded to the optical communication host through the electrical interface 200a. In other embodiments, the wavelength division multiplexer and the wavelength division demultiplexer can also be replaced by a photonic integrated chip (PIC) or other optical waveguide chips; the photonic integrated chip or the optical waveguide chip is bonded to the bottom plate of the first housing of the optical module by soldering or a thermally conductive adhesive.

[0048] In this embodiment, taking a dual-port optical module as an example, that is, providing one transmitting port and one receiving port, the above-mentioned first coupling lens group 250a is a coupling lens, and the second collimating lens group 250b is a collimating lens. In an optical module with more than two ports, such as with two transmitting ports and two receiving ports, the above-mentioned first coupling lens group includes two coupling

lenses

and the receiving-end optical receptacle in the housing of the optical module are located on a same side of the first housing (that is, a left or right side when facing the optical interface), and the receiving-end optical assembly such as the photodetector chips and the wavelength division demultiplexer, etc. and the transmitting-end optical receptacle are located on another side of the first housing. The first periscope 243a and the second periscope 243b overlap with each other, the first periscope 243a guides optical signals that are output from the wavelength division multiplexer to the side with the transmitting-end optical receptacle 260a that is a different side from the wavelength division multiplexer, and the second periscope 243b guides optical signals that are received by the receiving-end optical receptacle 260b into the wavelength division demultiplexer that is located on the side that is a different side from the receiving-end optical receptacle 260b. In this way, by designing an inclination angle of periscopes 243 relative to the bottom plate 213 of the first housing 211 as required, the optical path can be guided to a corresponding height, such that the layout design in the housing of the optical module becomes more flexible. Moreover, this design can lengthen a length of the periscope to facilitate the manufacture of the periscope and the coupling of the optical path.

[0050] In this embodiment, the optical processing assembly is bonded to the bottom plate 213 of the first housing 211 through an adhesive layer. At the transmitting-end, the first collimating lens array 271 is disposed on the TEC 233 or an electrical isolation layer, the wavelength division multiplexer 241 and the first periscope 243a at the transmitting-end are directly bonded to the bottom plate 213 through an adhesive layer (not shown in the figures); the thickness of the adhesive layer is adjusted according to the optical path, such

or a flange, etc., and the second limiting structure 266 may be a second protrusion on the outer periphery of the sleeve assembly 261, such as protrusions or flanges, etc. During assembly, the second protrusion abuts against the first protrusion to limit the position of the optical receptacle 260 in a lengthwise direction of the optical module 200.

[0057] As shown in FIG. 5, another embodiment of an optical receptacle is provided; the above-mentioned optical module can also use an optical receptacle of this embodiment, and the assembly method of the optical receptacle in the optical module is the same as the optical receptacle of the above-mentioned embodiment. The optical receptacle 260 of this embodiment also includes the sleeve assembly 261 and the optical fiber ferrule 262. The optical fiber ferrule 262 is provided in the sleeve assembly 261. In which, the sleeve assembly 261 is provided with a first end 263 and a second end 264, the first end 263 is used for coupling with the optical processing assembly in the optical module, and the second end 264 is used for connecting with an external optical fiber. The optical fiber ferrule 262 is disposed on a position in the sleeve assembly 261 adjacent to the first end 263, and a section of the sleeve assembly 261 adjacent to the second end 264 is used to receive the optical fiber ferrule of the external optical fiber when connecting to the external optical fiber. The difference is that, in this embodiment, an optical window 267 is provided at the port of the sleeve assembly 261 on the first end 263 of the optical receptacle 260, so as to seal the optical fiber ferrule 262 in the sleeve assembly 261, thereby effectively sealing and protecting the end surface of the optical fiber ferrule 262. In other embodiments, an optical window can also be directly attached to the end surface of the optical fiber ferrule adjacent to the first end.

In this embodiment,

optical device carrier. Taking the optical receptacle fixed on the optical device carrier as an example, the optical device carrier 380 is provided with a receptacle mounting part 381 at an end portion adjacent to the optical interface 300b, and the optical receptacle 360 is soldered, bonded, threadedly screwed, or snapped on the mounting part 381. The receptacle mounting part 381 may be a side wall provided at the end portion of the optical device carrier 380, and a receptacle accommodating groove 382 for mounting the optical receptacle 360 is provided on the side wall. The manner for mounting and positioning the optical receptacle 360 on the optical device carrier 380 can be the same as the manner for mounting and positioning the optical receptacle in the first housing in Embodiment 1, and will not be reiterated herein.

[0067] During assembly, the optical receptacle 360 and the optical processing assembly 340 are fixed on the optical device carrier 380 in a passive manner, and by adjusting a third lens group 350, optical signals are coupled between the optical processing assembly 340 and the optical receptacle 360. The photoelectric chips 330 are also passively fixed on the optical device carrier 380 or on a separate heat sink. The circuit board assembly 320 and the optical device carrier 380 carrying the photoelectric chips 330 and the optical processing assembly 340 are respectively mounted and fixed into the first housing 311 based on the first housing 311. The optical device carrier 380 and the rigid circuit board 321 do not need to be fixed to each other. Bonding wires (such as gold wires) are used between the photoelectric chips 330 and the rigid circuit board 321 to electrically connect the photoelectric chips 330 and the rigid circuit board 321, the first collimating lens array (a first lens group 371) is adjusted such that the optical signals emitted by the laser chips 331 are