CLAIMS

1. A method comprising:

actively aligning an optical connector with a first loopback alignment feature formed in a substrate of a photonic chip by coupling light from a light source external to the photonic chip via a first channel of the optical connector into the first loopback alignment feature and measuring light received from the first loopback alignment feature via a second channel of the optical connector with a detector external to the photonic chip, the loopback alignment feature being optically unconnected to a photonic integrated circuit (PIC) formed in the substrate of the photonic chip;

actively aligning the optical connector with a second loopback alignment feature formed, unconnected to the PIC, in the substrate of the photonic chip by coupling light from the light source via the first channel of the optical connector into the second loopback alignment feature and measuring light received from the second loopback alignment feature via the second channel of the optical connector with the detector;

following active alignment of the optical connector with the first and second loopback alignment features, moving the optical connector by a known vector from a position aligned with the second loopback alignment feature to a position aligned with the input/output couplers of the PIC, the known vector being based on known relative positions between the first loopback alignment feature, the second loopback alignment feature, and the input/output couplers of the PIC; and

locking the optical connector in place in the position aligned with the input/output couplers of the PIC.

2. The method of claim 1, wherein the first loopback alignment feature and the second loopback alignment feature form separate, optically unconnected structures.

3. The method of claim 1, wherein the first loopback alignment feature and the second loopback alignment feature form a single structure.

4. The method of claim 3, wherein the single structure comprises three grating couplers optically connected to each other, a distance between a first one of the

three grating couplers and a second one of the three grating couplers being equal to a distance between the second one of the three grating couplers and a third one of the three grating couplers.

5. The method of claim 1, wherein aligning the optical connector with the first loopback alignment feature comprises aligning the first and second channels of the optical connector with respective first and second couplers of the first loopback alignment feature, a distance between the first and second couplers being equal to a distance between two of the input/output couplers of the PIC.

6. The method of claim 1, wherein the input/output couplers of the PIC comprise at least one of grating couplers or turning mirrors.

7. The method of claim 6, wherein the first loopback alignment feature comprises two couplers optically connected to each other, the two couplers comprising grating couplers or turning mirrors.

8. The method of claim 6, wherein the loopback alignment feature comprises two grating couplers optically connected to each other to form a closed loop.

9. The method of claim 1, wherein the input/output couplers of the PIC comprise waveguide edge couplers.

10. The method of claim 9, wherein the first loopback alignment feature comprises a waveguide U-turn terminating at a same surface of the PIC as the waveguide edge couplers.

11. The method of claim 1, wherein the channels of the optical connector are input/output couplers of a second photonic integrated circuit (PIC) formed in a second photonic chip.

12. The method of claim 1, wherein the active alignment of the optical connector with the first and second loopback alignment features is performed without supplying electrical power to the PIC.

13. A photonic chip comprising:

a substrate;

a photonic integrated circuit (PIC) comprising a plurality of photonic devices formed in the substrate, the plurality of photonic devices comprising a first plurality of input/output couplers arranged in an array having a constant pitch; and

first and second loopback alignment features formed in the substrate, the first and second loopback alignment features being optically unconnected to the PIC and each comprising two couplers, a distance between the two couplers of each of the first and second loopback alignment features being equal to an integer multiple of the constant pitch of the array of input/output couplers of the PIC.

14. The photonic chip of claim 13, wherein the first loopback alignment feature and the second loopback alignment feature form separate, optically unconnected structures.

15. The photonic chip of claim 13, wherein the first loopback alignment feature and the second loopback alignment feature form portions of a single structure.

16. The photonic chip of claim 13, wherein the input/output couplers of the PIC comprise two grating couplers and the first and second loopback alignment features each comprise two grating couplers optically connected to each other.

17. The photonic chip of claim 13, wherein the input/output couplers of the PIC comprise waveguide edge couplers and the first and second loopback alignment features each comprise a waveguide U-turn terminating at a same surface of the PIC as the waveguide edge couplers.

18. A method of manufacturing a photonic chip comprising two loopback alignment features, the method comprising:

photolithographically patterning a substrate to simultaneously define, with a single photomask, a plurality of input/output couplers of a photonic integrated circuit (PIC) and the two loopback alignment features, the plurality of input/output couplers being arranged in an array having a constant pitch, the two loopback alignment features being optically unconnected to the PIC and positioned at specified locations relative to the plurality of input/output couplers, each of the two loopback alignment features comprising two couplers, a

distance between the two couplers being equal to an integer multiple of the constant pitch of the array of input/output couplers; and

processing the patterned substrate to create the photonic integrated circuit and the two loopback alignment features in the substrate.

19. The method of claim 18, wherein the at least two loopback alignment features comprise grating couplers.

20. The method of claim 18, wherein the at least two loopback alignment features form a single structure.