CLAIMS

1. A silicon optical circuit having a function of detecting a flaw occurred on an optical circuit element formed on a substrate, the silicon optical circuit is one of a plurality of optical circuit formed on the substrate, each of the silicon optical circuit comprising:

an optical waveguide arranged along at least a part of a contour of a target circuit having a predetermined function by the optical circuit element and arranged proximate at a distance that does not cause optical coupling with the target circuit; and

optical path conversion means disposed at both ends of the optical waveguide.

2. The silicon optical circuit according to claim 1, wherein the optical path conversion means is either of:

a pair of grating couplers; or

a pair of couplers composed of two optical path conversion circuits each having a terminating face of the optical waveguide and a total reflection face which faces the terminating face and which reflects light emitted from the terminating face substantially vertically relative to an SOI substrate.

3. The silicon optical circuit according to claim 1 or 2, wherein the target circuit, the optical waveguide, and the optical path conversion means are composed of a silicon fine wire formed on the SOI substrate.

4. The silicon optical circuit according to any of claims 1 to 3, wherein at least part of a linear portion of the optical waveguide is a multimode waveguide whose core width has been enlarged, and the multimode waveguide is connected to a waveguide of another portion of the optical waveguide via a tapered waveguide without mode conversion.

5. The silicon optical circuit according to any of claims 1 to 4, wherein the optical waveguide does not cross the target circuit and a portion of the optical waveguide along a contour of the target circuit is arranged so as to keep a distance of 50 μm or less from the contour.

6. The silicon optical circuit according to any of claims 1 to 5, wherein

the optical waveguide includes an outward portion arranged along a contour of the target circuit from one coupler of the optical path conversion means so as to substantially surround the target circuit and a return portion arranged by returning substantially parallel to the outward portion to reach the other coupler of the optical path conversion means, and

the couplers of the optical path conversion means are formed proximate and parallel to each other such that their incident angles face the same direction at the time of coupling to fiber components and an arrangement interval therebetween is 1 mm or less.

7. The silicon optical circuit according to any of claims 1 to 5, wherein

the target circuit includes at least two sub target circuits having an identical function or different functions,

the optical waveguide at least includes:

a loopback waveguide portion having an outward portion arranged along a contour of a first sub target circuit from one coupler of the optical path conversion means so as to surround the first sub target circuit and a return portion arranged by returning substantially parallel to the outward portion; and

a waveguide portion between the sub target circuits arranged continuously from the loopback waveguide portion of the first sub target circuit along part of a contour that is not surrounded by the loopback waveguide portion of the contour of the first sub target circuit or along at least part of a contour of a second sub target circuit that is different from the first sub target circuit, and

the couplers of the optical path conversion means are formed proximate and parallel to each other such that their incident angles face the same direction at the time of coupling to fiber components and an arrangement interval therebetween is 1 mm or less.

8. A silicon optical circuit having a function of detecting a flaw occurred on an optical circuit element formed on a substrate, the silicon optical circuit comprising:

a plurality of optical waveguides, each of which is for one of a plurality of target circuits formed on the substrate and

arranged along at least part of a contour of each of the target circuits and arranged proximate at a distance that does not cause optical coupling with each of the target circuits;

a plurality of corresponding optical path conversion means connected to the plurality of optical waveguides, respectively;

a common single optical waveguide which is arranged proximate to each of the plurality of target circuits and each of the optical waveguides corresponding thereto and which is configured to be parallel to each of the plurality of optical waveguides extending over all of the plurality of target circuits; and

common optical path conversion means connected to the common single optical waveguide.

9. A silicon optical circuit having a function of detecting a flaw occurred on an optical circuit element formed on a substrate, the silicon optical circuit comprising:

a plurality of optical waveguides, each of which is for one of a plurality of target circuits formed on the substrate and arranged along at least part of a contour of each of the target circuits and arranged proximate at a distance that does not cause optical coupling with each of the target circuits;

a first wavelength multiplex/demultiplex circuit in which one end of each of the plurality of waveguides is connected to each of a plurality of output ends and in which light input to the input end is wavelength multiplexed/demultiplexed to the plurality of output ends;

a second wavelength multiplex/demultiplex circuit in which the other end of each of the plurality of waveguides is connected to each of a plurality of output ends and in which light input to the input end is wavelength multiplexed/demultiplexed to the plurality of output ends, wherein the second wavelength multiplex/demultiplex circuit includes wavelength multiplexing/demultiplexing characteristics identical to those of the first wavelength multiplex/demultiplex circuit, each of the plurality of optical waveguides connected to the respective output ends having the same transmissible wavelength on the two wavelength multiplex/demultiplex circuits; and

optical path conversion means connected to the input end of the first wavelength multiplex/demultiplex circuit and the input end of the second wavelength multiplex/demultiplex circuit.