layer 203 is distributed to leak also outside of the region of the rib portion A0, when the high-concentration p-type semiconductor region 203 - 3 and the high-concentration n-type semiconductor region 203 - 4 are arranged to be close to the rib portion A0, the optical loss of the optical waveguide 123 increases. Accordingly, for preventing the high-concentration p-type semiconductor region 203 - 3 and the high-concentration n-type semiconductor region 203 - 4 from being arranged to be close to the rib portion A0, it is preferable that a distance W_{pn} between the high-concentration p-type semiconductor region 203 - 3 and the high-concentration n-type semiconductor region 203 - 4 is 1600 nm or more.

[0017] For realizing an optical modulator that is fast in a modulation speed, low in an optical loss and low in a drive voltage, it is required to realize an optical waveguide structure that is low in a loss and low in reflection to be capable of propagating the light without reducing intensity of the light in the waveguide, to cause an operation frequency band to be a high frequency, and to lower an phase inversion voltage $V\pi$.

[0018] Here, in the MZ type optical modulator, a modulation efficiency is found by a phase inversion voltage $V\pi \times$ a length L of a traveling wave (phase modulation) electrode. Then, when the length L of the traveling wave electrode is made short without changing the modulation efficiency to make the optical loss small, the phase

layer 403 as the core of the optical waveguide 323. In this case, in a doping region of the rib portion C0 in the Si semiconductor layer 403, since optical absorption by the carrier is made large, it is not possible to suppress the optical loss of the optical waveguide 323. Accordingly, the first method is not appropriate in the present embodiment.

[0047] Next, the second method will be considered. In the present embodiment, the third slab portion C3 and the fourth slab portion C4 thicker than the first slab portion C1 and the second slab portion C2 are provided further outside of the first slab portion C1 and the second slab portion C2. Providing the third slab portion C3 and the fourth slab portion C4 causes an increase in a cross-sectional area of each of the intermediate-concentration p-type semiconductor region 403-1 and the intermediate-concentration n-type semiconductor region 403-2. Then, it is possible to lower the resistance value of each of the resistances R1 and R2. At this time, when an optical waveguide in a distance W_{pn} in a region between the high-concentration p-type semiconductor region 403-3 and the high-concentration n-type semiconductor region 403-4 is made as wide as and as thick as possible, it is possible to obtain the better effect.

[0048] On the other hand, when the thickness of each of the first slab portion C1 and the second slab portion C2 is made closer to the thickness of the rib portion C0, leak of a field of light into the third slab portion C3 and the