Claims

1. A photodetector (3) comprising a longitudinal section (12) of a waveguide (11), which comprises or is formed by two waveguide segments (12a, 12b) extending in the longitudinal direction and at least substantially parallel to one another, the waveguide segments (12a, 12b) being spaced apart from one another forming a gap (14) extending therebetween, and an active element (13), which overlaps the longitudinal section (12) of the waveguide and comprises at least one material which absorbs electromagnetic radiation of at least one wavelength and, as a result of the absorption, generates an electrical photosignal, wherein the two waveguide segments (12a, 12b) respectively are in contact on the side facing the active element (14) at least in sections with a gate electrode (15a, 15b).

2. The photodetector (3) according to claim 1, **characterized in** that the gate electrodes (15a, 15b) comprise silicon.

3. The photodetector (3) according to claim 1 or 2, **characterized in** that the gate electrodes (15a, 15b) are each in contact at their underside with an upper side of the respective waveguide segment (12a, 12b) and are each in contact with their upper side with an underside of a dielectric coat provided between the active element (13) and the waveguide segments (12a, 12b).

4. The photodetector (3) according to any of the preceding claims, **characterized in** that the gate electrodes (15a, 15b) comprise a material which is transparent for electromagnetic radiation of at least one wavelength and electrically conductive.

5. The photodetector (3) according to any of the preceding claims, **characterized in** that each of the two gate electrodes (15a, 15b) is associated with a connecting element (8) in contact therewith, and in each case one of the connecting elements (8) extends through one of the waveguide segments (12a, 12b).

6. The photodetector (3) according to any of the preceding claims, **characterized in** that the active element (13) overlaps the two waveguide segments (12a, 12b) and the gap (14) lying therebetween at least in sections.

7. The photodetector (3) according to any of the preceding claims, **characterized in** that the at least one material of the active element (13), which absorbs electromagnetic radiation of at least one wavelength and generates an electrical photosignal as a result of the absorption, is one or more of a group comprising: graphene, at least one dichalcogenide, heterostructures of two-

dimensional materials, germanium, at least one electro-optical polymer, silicon, at least one compound semiconductor.

8. The photodetector (3) according to any of the preceding claims, **characterized in** that the longitudinal section (12) of the waveguide (11) is arranged on or above a planarization coat (2, 17), wherein the planarization coat (2, 17) is characterized, at least in sections, by a roughness in the range from 1.0 nm RMS to 0.1 nm RMS on the side, on which the longitudinal section (12) of the waveguide (11) is arranged on,
and/or in that the longitudinal section (12) of the waveguide (11) is embedded at least in sections in a planarization coat (2, 17) and the active element (13) or one of the active elements (13) is arranged on the planarization coat (2, 17), wherein the planarization coat (2, 17) is characterized, at least in sections, by a roughness in the range from 1.0 nm RMS to 0.1 nm RMS on the side on which the active element (13) is arranged on.

9. The photodetector (3) according to any of the preceding claims, **characterized in** that the longitudinal section (12) of the waveguide (11) comprises one or more of a group comprising: titanium dioxide, aluminium nitride, tantalum pentoxide, silicon nitride, aluminium oxide, silicon oxynitride, lithium niobate, silicon, indium phosphite, gallium arsenide, indium gallium arsenide, aluminium gallium arsenide, at least one dichalcogenide, chalcogenide glass, heterostructures of two-dimensional materials, resins or resin-containing materials, polymers, polymer-containing materials.

10. A semiconductor apparatus comprising a chip and at least one photodetector (3) according to any of claims 1 to 9, wherein the photodetector(s) (3) .

11. The semiconductor apparatus according to claim 10, **characterized in** that the photodetector (3) is part of a photonic platform fabricated on the chip or bonded to the chip.

12. A semiconductor device comprising a wafer (1) and at least one photodetector (3), preferably a plurality of photodetectors (3) according to any of claims 1 to 9.

13. The semiconductor device according to claim 12, **characterized in** that the photodetector (3) is part of a photonic platform fabricated on or bonded to the wafer (1).