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SINGLE-PHASE DEVICE WITH THE CHARGE LINK, GUIDED BY P-N-JUNCTIONS

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INTRODUCTION

Devices with the charge links guided by p-n-junctions (DCLGJ), built according to the three-phase control circuit, have comparatively low transmission efficiency and insufficient interference immunity due to the transfer channel inhomogeneity, conditioned by the gap existence between the gates. The three-phase mode of the generators complex circuits of the tact impulse consumes sufficient energy.

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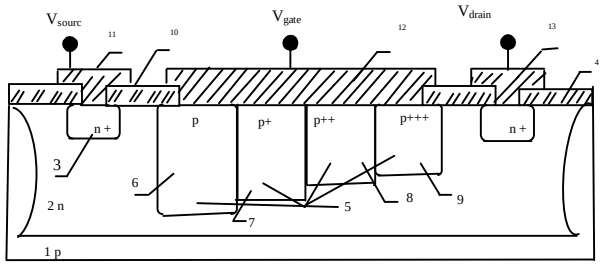
For improving the charge transfer and DCLGJ interference immunity efficiency, diminishing the consumed energy and the circuit simplification the DCLGJ structure with the single-phase mode is suggested (see Fig. 1).



1 – base; 2 – channel region; 3 – source; 4 – drain; 5,6,7,8,9 – gate fields; 10 – insulating layer; 11,12,13 – metal contacts.

Figure 1 DCLGL single-phase structure

For DCLGJ production of such a type the planar technology can be used. For providing the single-electron control system two conditions should be fulfilled. Firstly, the potential of the device transfer channel with the charge link at applying the voltage to the gate 5 under the adjacent fields 6, 7, 8, 9 must be different. Secondly, each of the gate fields must contain the built – in asymmetry for defining the voltage of the charge transfer. The first condition is achieved due to the complex gate formation consisting of several fields 6, 7, 8, 9 with the different impurity concentration and the second – due to the different field depth. The ratio of the field depth is in inverse proportion to the ratios of the impurity concentrations [1].

At supplying the voltage of the reversed polarity drift to p-n-junction, formed by the epitaxial layer of n-silicon 2 and p-base 1, under the influence of the arising electric field, n-field between the source 3 and drain 4 will be depleted from the main charge carrier and near the interface of this p-n-junction the transfer channel appears [1].

At applying to the gate 5 the voltage of the corresponding sign and value Vg_1, drifting the p-n-junction, formed by the gate 5 and epitaxial layer 2, in reverse direction under the 6, 7, 8, 9 gate fields the potential pits of different depth are formed, i.e. the potentials of the transfer channels will be different.

The transfer channels potentials under the 6,7 fields will be higher than the channel potentials under the 8,9 fields and that's why the charge packet, injected with the help of p-n-junction or due to the optical generation near the 6 gate field, will be spread in the transfer channel under the neighbouring 7 gate field. At supplying to the gate 5 the voltage the transfer channel potentials under the fields 8,9 will be higher, than the channel potentials under the fields 6, 7 and the charge packet will flow to the potential pits under the fields 8,9. Due to the incorporation of the complex gate of the realization of the single-phase mode is achieved and the overlapping by the gate of the whole channel of the charge packet transfer, that results in the improvement of the transfer efficiency, noise immunity, decrease of the consumed energy and simplification of the control circuits.

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