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A Unipolar Structure Applying Lateral Diffusion

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A UNIPOLAR STRUCTURE APPLYING LATERAL DIFFUSION

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A Unipolar Structure Applying Lateral Diffusion

This communication describes a new method of fabricating a high transconductance, high-frequency unipolar structure by means of lateral diffusion. Design consideration for optimum performance of a unipolar device requires the channel between the source and drain to be narrow, short and uniformly doped.1,2 (Fig. 1)

In addition, the gate region should be more heavily doped than the channel so that the depletion region will extend into the channel rather than into the gate.1,2 The phenomena of lateral diffusion can be utilized to construct a silicon device corresponding to the description.

Narrow SiO₂ masking strips are formed over the areas intended for channels (Fig. 1) in preparation for a boron diffusion. The boron then diffuses into the silicon, not only downward, but also laterally under the oxide stripe. It may be noted that the total

* Received January 21, 1962.
A 3 micron deep, $n^+$, phosphorus diffusion results in the configuration shown in Fig. 2. The device is built into an $n$ type, 15 ohm-cm, 15-micron deep epitaxially grown layer. The substrate is 0.01 ohm-cm silicon chosen to reduce the series resistance.

Using the Shockley analysis for unipolar devices, $f_{max}$ for this device is approximately 1 kMc. An RC analysis of the device gives about the same frequency response if the capacitance of the diffused source contact is neglected. Improved photomasking techniques will eventually permit the elimination of the diffused source contact and this capacitance.

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