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Segaram et al.

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(54) **METHOD OF BONDING A SEMICONDUCTOR DIE WITHOUT AN ESD CIRCUIT AND A SEPARATE ESD CIRCUIT TO AN EXTERNAL LEAD, AND A SEMICONDUCTOR DEVICE MADE THEREBY**

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(51) **Int. Cl.**⁷ **H01L 29/72**

(52) **U.S. Cl.** **257/778; 257/723; 257/672; 257/173; 438/110; 438/14; 438/15**

(58) **Field of Search** **257/173, 778, 257/783, 723, 110, 14, 15**

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(57) **ABSTRACT**

In a semiconductor device having a semiconductor die without an ESD circuit and a separate ESD circuit and an external lead, the external lead is first bonded to the separate ESD circuit. Thereafter, the separate ESD circuit is bonded to the semiconductor die. As a result, in the process of bonding the semiconductor die, any ESD disturbance is absorbed by the ESD circuit. In addition, a semiconductor device such as a DDR DRAM memory device, has a chip carrier with a first surface having a plurality of leads and a second surface opposite to it with an aperture between them. A semiconductor die with a mounting surface and a bonding pad faces the second surface with the bonding pad in the aperture. An ESD circuit is mounted on the mounting surface in the aperture. A first electrical connector connects one of a plurality of leads to the ESD circuit and a second electrical connector connects the ESD circuit to the bonding pad.

20 Claims, 8 Drawing Sheets

