

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
27 May 2004 (27.05.2004)

PCT

(10) International Publication Number
WO 2004/044950 A2

(51) International Patent Classification⁷: **H01L**
(21) International Application Number:
PCT/US2003/033945
(22) International Filing Date: 24 October 2003 (24.10.2003)
(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data:
10/291,126 7 November 2002 (07.11.2002) US
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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

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(54) Title: SEMICONDUCTOR SUBSTRATE HAVING COPPER/DIAMOND COMPOSITE MATERIAL AND METHOD OF MAKING SAME

(57) Abstract: A semiconductor package for power transistors of the LDMOS type has a metallic substrate with a die mounted directly thereon, lead frame insulators mounted thereon adjacent the die and a plurality of leads mounted on the insulators and electrically coupled to the die by bond wires. The substrate includes a body having opposite surfaces comprising pure copper layers, and with the body interior being at least partially comprised of a copper/diamond composite so as to act as a heat spreader and provide improved heat removal and low thermal expansion, as well as an electrical connection for the die. The body may be entirely comprised of a copper/diamond composite, or it may be comprised of a copper/tungsten composite having a copper/diamond composite insert therein. The copper/diamond composite is comprised of diamond, particles within a copper matrix. In a method of making the copper/diamond composite, diamond particles are coated with multiple layers of element or inorganic compounds, mixed with a dry-processing binder and compacted in a die under pressure to form a compacted body. The body is placed on a quantity of copper, heated in a vacuum or hydrogen atmosphere to evaporate or decompose the binder, heated in a vacuum or hydrogen atmosphere to cause bonding or partial sintering of the coated diamond particles, then heated in a hydrogen atmosphere to a temperature slightly above the melting point of copper to melt and draw the copper into the bonded or partially sintered diamond particles. Following that, the compacted body is cooled and cut to the desired shape.

WO 2004/044950 A2