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Press-pack and Soldered Packaging IGBT Modules for Pulsed Power Applications

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In the microsecond and sub-microsecond pulsed power area, compared with other traditional gas switches, the IGBT switch has the advantage of short recovery time, high reliability and high power density, etc. The soldered IGBT has high parasitic inductance and failure problem due to the wire bonding and single-side heat dissipation, while the new type of press-pack IGBT could make an effective improvement. In order to compare the performance of IGBTs in pulsed power applications with those two types of packaging styles precisely, taken the packaging parameters of the commercial devices as a reference, the finite element simulated models for the soldered and press-pack modules with the same current rate of 1200A are established, separately. The parasitic inductance abstracting results show that the collector and emitter inductance of the press-pack IGBT are only 2.1% and 14.5% of that of the soldered one. Because the soldered IGBT has more parallel branches, they have shown similar current rise rate. On the repetitive frequency operation modes, the soldered IGBT gets lower average temperature by much larger heat sink, but the press-pack IGBT has higher power density because of the compact structure. In order to verify the characteristics difference of the two types of IGBT applied in the pulsed power applications, the pulsed power platform based on the press-pack IGBT and the soldered IGBT is established. Through the experimental measurement for the pulse waveforms and temperature distributions, the simulated results have been proved to a certain extent. In general, the press-pack IGBT has lower packaging parasitic inductance, double-sided heat dissipation, higher power density, easier to be pressed into stacks and short circuit failure mode, etc., which makes it have more advantages in the pulsed power applications. The discussion and analysis based on the models of commercial devices give us the information in detail and quantitatively.

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