

## Packaging technologies for RFICs: current status and future trends

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In the current wireless market, competitive pressures are driving the electrical performance of RF integrated circuit (RFIC) devices to new levels. At the same time, the demands placed on packaging of these RFICs have caused more resources to be focused on solutions. The result has been that high frequency packaging is called upon to provide low cost, thermally efficient, miniaturized products for a wide range of wireless telecommunications applications. The packaging of RFICs covers a wide range of technologies, with a number showing promise for future developments. The end applications for these packaged devices range from fixed base systems to high portability, handheld uses. Both types require that aggressive performance and economic consideration be paid to packaging technique. The dominant package options are the single chip plastic encapsulated RFIC and its cousin, the ceramic package. Advanced package technologies include the many forms of multiple chip modules (MCM), leadless array packaging (including ball grid array (BGA) and near-chip scale packages), as well as thermally enhanced packaging in ceramic and laminate substrate materials. In looking ahead to the next generations of packages, a key determinant lies on the road to advanced packaging for RFICs. System level integration and manufacturing technology for wireless products will likely remain primarily surface mount technology (SMT). With this constraint; smaller, higher levels of device integration, increased thermal capability and integration will place increased burdens on packaging technology. Some insights into potential emerging technologies and their enabling requirements will be offered.

 [Return to main document.](#)