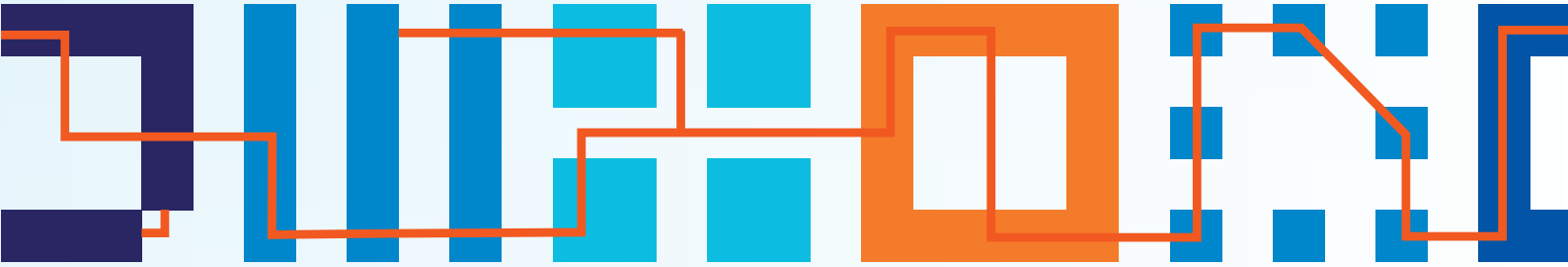
CITC

Chip Integration
Technology Center



Integration for Tomorrow

Chip Integration Technology Center (CITC) is a non-profit innovation center that specializes in heterogeneous integration and advanced packaging.

CITC offers:

- Access to innovation
- Access to infrastructure
- Access to education

Smart solutions to global challenges.

Joint Innovation Center

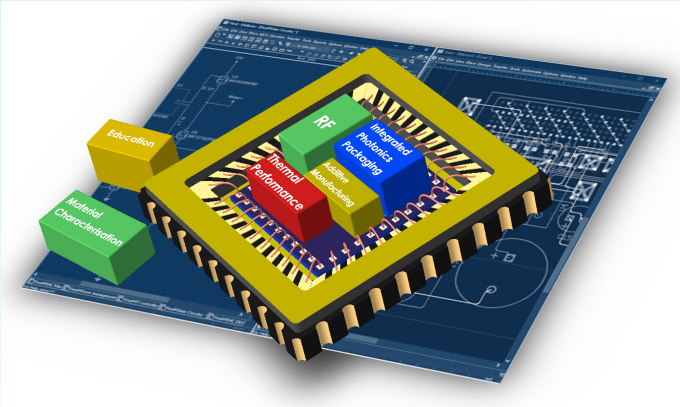
CITC is a joint innovation center where companies, research and educational institutes work together on integration and packaging technology.

Chip integration and packaging technology includes challenges such as those presented by placing more and more chips and functions in a single package (also called 'System in Package' or 'SiP'), high performance die-attach materials for power electronics and design and material characterization for RF devices.

Societal Challenges

Future societal challenges relating to energy, healthcare, mobility and agriculture/food mean that increasing degrees of 'smartness' need to be built into products and services. As a key enabling technology, chips make this smartness possible. A smart and complex form of integration and packaging is required to combine all functionality into one package. This makes the device not only smarter, but also smaller and cheaper, and above all, more energy-efficient.

Chip integration is therefore regarded worldwide as the main challenge in the development of the next generation of semiconductor devices, a generation that will open doors to even smarter and more energy-efficient products. Chip integration goes much further than just traditional packaging ('making a box around the chip'), and can really be seen as an integral part of the device's function.



Focus Areas

CITC offers access to innovation, infrastructure and education. This means CITC:

- organizes and runs innovation programs in the field of packaging and integration technology for chips;
- provides access to lab infrastructure as one of its key capabilities;
- shares knowledge about integrated chip technology and its applications.

Way of Working

CITC runs research programs on specific topics in close collaboration with partners and customers. Customers can join these programs through open collaboration (joint innovation with multiple participants) in a non-competitive environment. In this way, CITC creates an ecosystem where device manufacturers (IDM), equipment manufacturers (OEM), material suppliers and system integrators create added value by innovating throughout the value chain. Customers' collaboration typically takes the form of multi-year program participation or a customized project (contract research). Academic projects (MSc, PhD or post-doc) are also possible.

Advantages of Joint Innovation

CITC brings IDMs, OEMs, material suppliers and system integrators together in pre-competitive joint innovation programs. Sharing of competencies and facilities is maximized, while the costs are optimized and public funds can be added. Early involvement of material and equipment suppliers gives the opportunity to design better application-specific solutions that may lead to de facto new industry standards. This collaborative approach reduces the time to market and risks through a joint pre-competitive technology roadmap. In this way, all partners create a unique ecosystem around defined clusters of innovation and a strong global value chain.

CITC Chip Integration Technology Center

CITC Program Lines

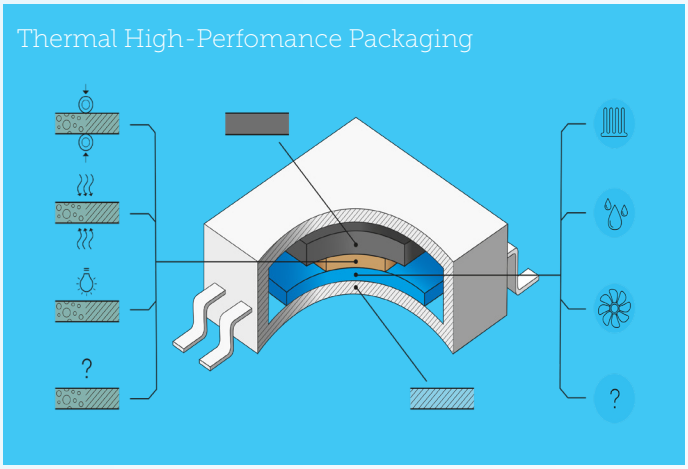
CITC has currently defined four program lines.

These program lines are the following:

1. Thermal High-Performance Packaging
2. RF Chip Packaging
3. Digital Package Manufacturing
4. Integrated Photonics Packaging

Thermal High-Performance Packaging

There is a trend towards increased power generation by semiconductor devices, due to factors including the move to Wide-Band Gap (WBG) materials such as gallium nitride (GaN) and silicon carbide (SiC). This creates more and more challenges when it comes to power dissipation and mechanical stresses in a package occurring at elevated temperatures.

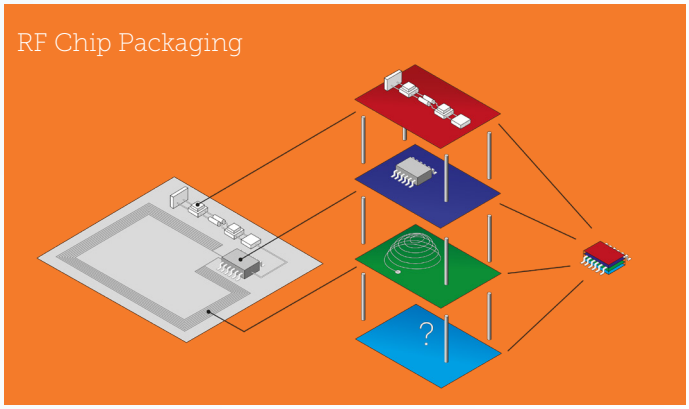


In this respect, successfully determining which materials and processes are reliable for packaging is crucial to the mass commercialization of power and WBG semiconductors and will help improve the reliability of existing and future WBG-based packaging. In particular, die attach and molding appear to be performance and reliability-limiting factors, which do not yet allow semiconductor power devices to operate at their full potential. Addressing the aforementioned technological challenges, one of CITC's primary focuses within the Thermal High-Performance Packaging Program is the development of novel thermo-mechanical design strategies and device packaging platforms composed of low-stress and high-reliability rugged interconnects and molds with high power dissipation capability.

RF Chip Packaging

A large number of new high-volume applications, especially in the mobile and automotive sectors, are moving towards the mmWave frequency domain. These applications drive the need to integrate new functionalities into the package, including mmWave die-to-board connections, waveguide launchers and antennas. This higher level of integration poses many technological challenges and calls for new solutions for low-loss interconnect, EM shielding and antenna integration, among other things. Furthemore, the packaging for mmWave devices must meet the miniaturizing requirements imposed by mobile applications or comply with the stringent reliability standards for the automotive domain.

CITC's RF Chip Packaging program focuses on the development of mmWave integrated solutions including the development of Antenna in Package (AiP) concepts, advancing the current package approaches and the underlying technologies.
This is done using co-design methodologies and prediction models combining expertise on antenna and RF design, packaging manufacturing technologies and materials.



Digital Package Manufacturing

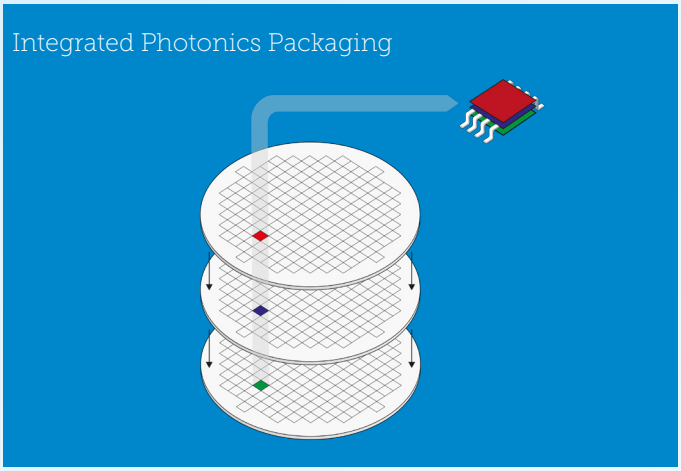
With additive manufacturing (AM) technologies (both 2D and 3D) significantly maturing in recent years, AM tool boxes create an opportunity for new packaging concepts to be developed and manufactured with increased design freedom, reduced manufacturing complexity and at a lower cost. In this respect, CITC focuses on deployment of recent advancements in AM technologies for building chip packages or parts thereof.

Using relevant prototypes, CITC aims to demonstrate new types of chip packages built with AM. Furthermore, within the CITC ecosystem in collaboration with material and equipment companies, CITC aims to further evaluate and develop the possibility of AM for digital manufacturing of next-generation packages.

Integrated Photonics Packaging

Today, developments in photonic integrated circuits open up new functionalities and applications. Packaging and assembly technologies are crucial to make devices available for high-volume and low-cost applications. This includes heterogeneous integration: the dense integration of compound semiconductor photonics and silicon micro-electronics. It allows for significant reductions in system size, weight and power, while simultaneously yielding performance improvements and new functionality.

Specifically, photonics merged with microelectronics is a key enabler for smarter photonics and faster electronics and is crucial for novel applications in the automotive (Lidar), medical and data communications (including Lifi) fields and many others. CITC will address topics such as thermal management, high I/O chip-to-chip interconnect, chip-to-chip alignment reliability and cost related to the integration of photonics with microelectronics or other microsystems. These developments will be supported with advanced modelling and simulations to optimize material choices and process flows.



More information

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