Analog/RF Design Challenges

Substrate designers face significant challenges in integrating RF circuits into a design. Today’s advanced designs are more complex and need to incorporate all design portions such as digital, RF, and analog circuits on the same substrate. To deal with this complexity, designers must be able to create an RF design within an integrated, production-ready packaging design environment.

RF modules are different from digital circuits in many respects. For example, distributed RF components are usually parameterized with widths and lengths; RF circuits have symmetric structures, with many large irregular shapes used for RF layout. Designers need a feature-rich, efficient, reliable, and easy-to-use RF design tool to handle all these design needs.

RF Layout Option

The Allegro Package Designer Plus RF Layout Option is the answer. This RF design solution combines the strength of both Cadence Allegro and Keysight ADS design environments for designing and integrating RF circuits on package substrates. The RF Layout Option provides everything needed to develop complex RF designs simply and quickly in an integrated environment with Allegro DE-HDL and Allegro Package Designer Plus.

The RF Layout Option provides a robust set of layout functionalities: parameterized etch element generation, quick placement, RF-style routing, editing of RF etch elements, and the ability to place via arrays along user-specified objects such as an RF component, a connect line (cline), or a discrete component. The generated etch elements will be recognized as RF components with parameters. Users can easily change the parameters of the elements after they are placed, and the system will re-generate those elements.

The RF Layout Option also supports complex copper shape creation and editing with its Shape Application Mode. With the ability to understand RF components in substrate layout, the RF Layout Option offers the unique capability of layout-driven design,

Figure 1: The RF Layout Option supports creation and editing of complex RF components
which generates the RF circuit schematic changes in Allegro DE-HDL for new RF elements introduced in substrate design. The RF Layout Option also supports different design flows working with RF design and analysis tools from Keysight. It provides a bi-directional interface for design data exchange (partial or complete), a discrete component translator, and the import of schematics from Keysight ADS.

Benefits
- Shortens time to integrate RF circuits
- Seamlessly integrated with Allegro DE-HDL and Allegro Package Designer Plus
- Provides a complete RF design solution using a unified design environment and database
- Improves design productivity and reduces design time for complex RF shape creation, RF trace routing, and via arrays
- Enables designers to use the same front-to-back and back-annotation flow for both digital and RF designs

Features
Parameterized Etch Elements
The RF Layout Option enables creation and editing of RF etch elements that are parameterized to enable their use in RF circuit design creation. There are more than 600 such parameterized elements, from microstrip to stripline to lumped components.

RF Layout
The RF Layout Option provides a powerful and flexible set of manual and interactive placement, routing, and editing tools within Allegro Package Designer Plus. Since the RF Layout Option understands RF etch elements, it provides a very easy mechanism for the creation, placement, and connection of RF components. It easily routes an RF trace with different bend styles such as optimally mitered RF bend, curve, or square. It can also connect two points by a direct RF trace or a meander. Other RF layout features include:
- Move, rotate, flip, and copy individual RF components or a selected set of objects (shape, cline, etch elements, vias)
- Group copy, flip, and rotate RF components or a selected set of objects
- Push RF components or a group of etch objects from one layer to another
- Change RF parameters and re-generate RF etch components
- Insert an RF component during the RF routing process
- Electrical calculation and display for RF trace
- Define a custom RF component
- Convert RF components to shapes
- Convert Allegro clines to transmission line components
- Chamfer corners of a RF trace
- Variable/expression display and modification
- Replicate RF circuits quickly, including flip mode for symmetrical/balanced circuits

RF Edit and Shape Application Modes
These application modes include a robust set of editing functionality for line, shape edge, vertex, or whole shapes. They enhance the existing Allegro Package Designer Plus line/shape editing functions, providing powerful and flexible functions for copper editing, adjustment, and resizing. This capability increases the flexibility to modify RF shapes and is particularly helpful for cases in which irregular shapes are used heavily, such as power amplifier circuits and filter circuits.

Allegro DFI from Keysight ADS
The Advanced Design System (ADS) from Keysight includes a design flow integration (DFI) for Allegro technology that allows import of traces, vias, lumped elements, bonds wires, and ball grid arrays for analysis using the 3D electromagnetic field simulators in ADS. Besides the multi-port frequency response output data (S-parameters), ADS provides 3D visualization tools for geometry, fields, and currents. This insight into the physical behavior of internal nodes lets engineers adjust the design to meet performance goals.

RF Schematic Import
Allegro DE-HDL allows engineers to import RF circuits from the Keysight ADS design environment to integrate with digital/analog portions of the substrate design. The schematic import uses a wizard-driven flow, simplifying the process of symbol creation and schematic update. All parametric RF components are mapped to Allegro RF libraries automatically. A packaged part can be mapped to an existing library using the Universal Component Browser or an Allegro symbol can be created using the information from the imported design.

Allegro DE-HDL supports variables/expressions and hierarchical structures.

Via Arrays
RF designers use via arrays on RF circuits to provide good grounding and shielding and to mitigate electromagnetic radiation effects. The RF Layout Option provides an easy method to instantiate an array of vias in a controlled pattern. Users can place these vias along the boundaries of RF etch components, any copper shape boundary, or along the discrete components.

Layout-Driven RF Design
The RF Layout Option enables the back-annotation process to automatically generate schematics for RF sub-circuits that were added to the RF layout. This allows RF engineers to create elements in layout, model them using Momentum, and then validate them through simulation using ADS. Automating the creation of schematics for added RF elements reduces the time it takes to update schematics once the RF circuit is validated.
Bi-Directional Interface with ADS Layout

The bi-directional physical interface between Allegro Package Designer Plus and Keysight ADS enables designers to implement their RF layout designs either in the Allegro environment or in the ADS environment. With substrate RF features, designers can implement the RF design with parameterized components based on a pre-defined RF library or create desired flexible shapes and lines with FSE functionality. The layout structure in Allegro Package Designer Plus can be transferred to ADS quickly and accurately. It also enables any change/optimization for layout structure in ADS based on electromagnetic simulation to be back-annotated to Allegro Editor.

Discrete Components Library Translation

The RF Layout Option allows users to translate discrete, packaged parts from ADS to the Allegro parts library, such as schematic symbols and package footprints. The schematic and layout files are handled at the same time.

Operating Systems

- Works with Microsoft Windows and Linux

Cadence Services and Support

- Cadence application engineers can answer your technical questions by telephone, email, or internet. They can also provide technical assistance and custom training.
- Cadence-certified instructors teach more than 70 courses and bring their real-world experience into the classroom.
- More than 25 Internet Learning Series (iLS) online courses allow you the flexibility of training at your own computer via the internet.

For More Information

Contact Cadence sales at 1.800.746.6223 or visit www.cadence.com/contact_us to locate a Cadence sales office.