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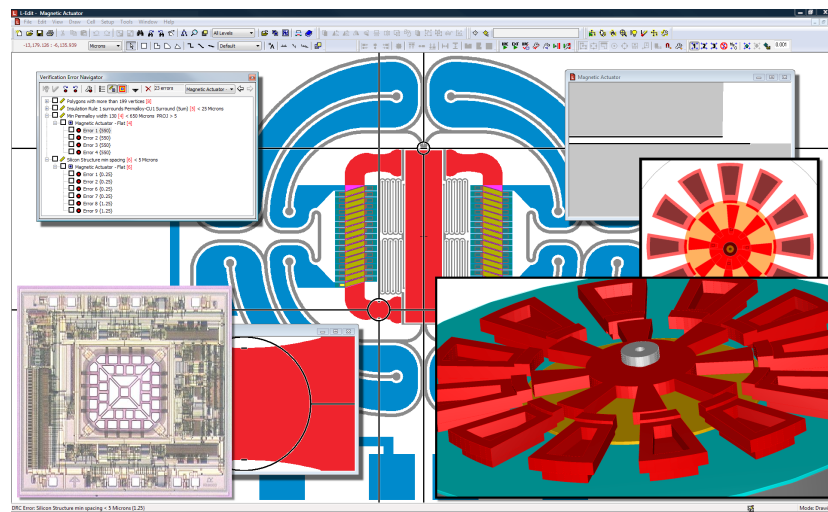
# Tanner MES Design Flow

## Features and benefits

- A complete 3D MEMS and IC design solution in one unified environment
- 25 years' experience with MEMS tools
- Create a MEMS 3D model from layout
- Highly programmable layout editor with MEMS-friendly capabilities, such as curved polygons
- Parameterized layout generators help create complex MEMS structures
- Complete layer and design geometry visualization
- Easily create, place and align MEMS structures with the alignment toolbar or the L Comp composition library
- Design Rule Checking (DRC) for MEMS manufacturability
- Import DXF with boundary reconstruction and export DXF
- SoftMEMS Tools Upgrade Option:

  - Advanced 3D analysis tools: mechanical, thermal, acoustic, electrical, electrostatic, magnetic and fluidic analysis
  - System-level simulation, co-simulation of IC design and MEMS device
  - Automatically generate behavioral models of MEMS device from 3D analysis results

## The MEMS Design Tool Leader

In today's MEMS design world, integration is more important than ever. To compete in a high-efficiency, high-productivity marketplace, you need a toolset that has proven its ability to accelerate the design cycles of commercially successful projects. The Tanner MEMS design flow not only makes integration of MEMS devices with analog/mixed-signal processing circuitry easy but also delivers the tools you need to improve the manufacturability of MEMS devices. And this leading MEMS and analog/mixed-signal IC design tool enables you to get started with minimal training, shortening the design cycle.

A central part of the design flow is Tanner L-Edit MEMS, an advanced layout editor with MEMS-friendly capabilities such as curved polygons and all-angle Boolean operations. In contrast to other CAD tools designed for mechanical engineering, L-Edit MEMS shows clear and dark fields of the masks. As a result you can quickly draw and edit masks, and then easily view different combination of masks to examine their overlaps and interactions. Using powerful features such as excellent curve support, interactive DRC, Boolean operations, object snapping and alignment, you can work more efficiently to save time and money. L-Edit MEMS gives greater precision by performing complex Boolean and derived layer operations with polygons of arbitrary shape and curvature. Perform



A central part of the MEMS design flow, here Tanner L-Edit MEMS is shown being used to design a magnetic actuator; the tool allows for the quick creation of entire complex curved shapes for MEMS from just a few easily drawn shapes.

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# Tanner MES Design Flow

**Features and benefits** *continued*
- Platform independence on Windows or Linux
- Ease of use: intuitive and short learning curve
- Unparalleled customer support
- Flexible licensing

AND, OR, XOR, Subtract, Grow and Shrink on groups of objects. This allows you to quickly create entire complex curved shapes for MEMS from just a few easily drawn objects.

**Advanced Design Rule Checking**
Tanner L-Edit MEMS Plus has advanced design rule checking to help you easily find design flaws and improve yield. You can easily set up rules with its graphical interface, making the tool configurable for any technology. This is important since most MEMS processes are very specialized or proprietary. L-Edit MEMS Plus helps shorten verification time with the advanced Verification Error Navigator that takes you instantly to the location of a violation in the layout editor and provides a clear and thorough summary report of DRC results.

**MEMS 3D Modeling**
The 3D Solid Modeler add-in allows you to create a 3D model of a MEMS device from a selected layout area and fabrication process description. The easy-to-use Technology Manager allows you to enter fabrication process steps and sequences as well as material properties. Surface and bulk micro-machining process steps are supported, such as material deposit, etch, mechanical polish, diffusion, growth, electroplating and wafer manipulation steps. The 3D model may be scaled and a subset of mask layers may be selected for view. Models can be viewed with rotations, zooms, preset views and step-by-step display of the fabrication sequence. It's also possible to animate models to show process sequences.

The Cross Section Viewer displays a cutaway view in the z-dimension based on a user-specified cut line. Boundary conditions may be defined on mask layout and can be automatically transferred along with either a 2D or 3D model to third party analysis or viewing programs in popular formats (e.g. SAT, APDL and IGES). Models may be "de-featured" for efficient FEM meshing. A MEMS-specific mesher creates efficient meshes for analysis.

The EasyMEMS tool helps to automate tasks that are time-consuming for creating MEMS mask layout, such as creating polar arrays. Useful macros include the generation of holes and dimples to properly release MEMS structures. A library of scalable MEMS device layouts is provided through a graphical library browser. The library devices are linked to user-specified or foundry design rules to ensure manufacturability. The library includes thermal, mechanical, optical, fluidic, and electrostatic devices.

**System-Level Simulation for MEMS**
You can upgrade the MEMS design tool suite with MEMS Pro to run system-level closed loop simulations of your IC and MEMS. The simulation is done completely in SPICE with the MEMS device as a behavioral model. Non-electrical domains are handled by mapping them into the electrical domain for simulation. A library of composable MEMS models is included; the library is parameterized by process parameters, material properties and device dimensions.

MEMS Modeler automatically generates behavioral models ready for system simulation with electronics and packaging using 3D data from finite element analysis programs. Complex finite element models involving a large number of degrees of freedom are reduced to behavioral models with a few master degrees of freedom. Users can also create their own models from analytical equations and the tool generates simulation-ready descriptions in a variety of popular formats. MEMS Modeler facilitates the bridge between 3D and system simulations enabling design teams to work together.