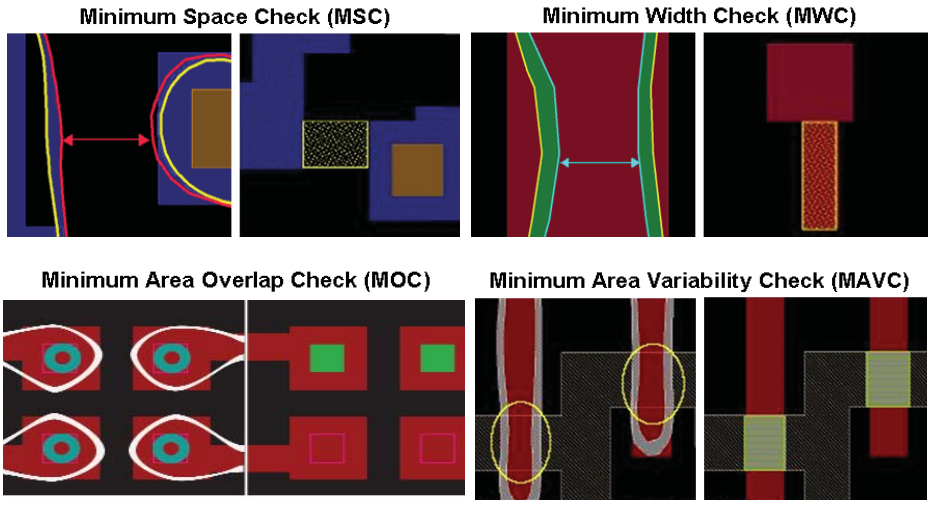
Calibre LFD

D A T A S H E E T



Calibre LFD uses process variation (PV) bands that predict failure in common configurations including pinching, bridging, area overlap and CD variability.

Litho Friendly Design: Capturing Process Variations in the Design Flow

Designers are adopting new methods of design for manufacturing (DFM) techniques with the goal of improving yield. But in order for a DFM recommendation to be of value to designers, it must include details about how a particular design will manufacture given the specific process. This requires a tool that can communicate an awareness of the process window at all stages of the design flow.

This capability is the key benefit of Mentor Graphics new Litho-Friendly Design solution, Calibre® LFD. It captures information on process window effects so that designers can improve the layout to make a design more robust and much less sensitive to process window variations.

Calibre LFD relies on "process kit" information, encompassing RET recipes, process models and parameterizable rules to be checked. With this kit, designers can run simulations to see how their layout will print under a particular lithographic process window. The simulation results include recommendations about areas in which modifications would be most likely to improve yield. Designers can then make modifications to the layout in their native layout design environment.

By practicing manufacturing process-aware design, the goal of achieving a "DRC clean" design will evolve to a "DRC and LFD clean" design.

Key Product Benefits

- **Gives users the ability to improve yield** by creating a design that is less sensitive to variations in a given manufacturing process.
- **Lithography effects are simulated** using product proven RET recipes and process models. Systematic effects are modelized.
- **LFD Kit predicts and captures areas of potential design failure** due to the manufacturing process and specific process conditions and communicates issues to the designer for possible layout modification.
- **Design Variability Index (DVI™)** provides data that helps the designer make decisions about which layout configuration is best for increased robustness to process variation.
- **LFD data reporting presented in a user-friendly DRC-type form** that can be classified, sorted and include comments for possible solutions, all within the design environment.
- **Easily integrated into the design flow** for interactive and iterative processes.
- **Fully integrated with the Calibre platform**, popular layout environments and industry standard formats.
- **Part of the Calibre design for manufacturing solution**, which also includes analysis, enhancement and diagnostics for design, manufacturing and test areas.

Mentor Graphics®

How LFD Works

A litho-friendly design checking performs three important tasks:

• Gathers data about how the design will print at a range of conditions, such as dose, focus, mask and bias, not just at the optimal settings

• Predicts specific failures or potential yield inhibitors

• Assigns each portion of the design a manufacturability score reflective of how well that portion will manufacture given the specific process window

Data about the layout and its likely response to manufacturing variations is gathered through advanced techniques that incorporate process variation (PV) bands. It represents the area within which a feature will print as the process conditions vary. The band is generated by calculating the silicon-printed image at the various process conditions and combining the resulting images into a band.

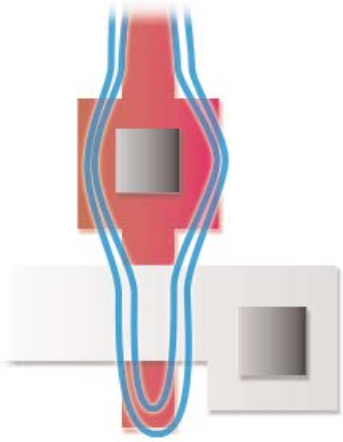


Fig 2: PV Band of a poly gate: in Grey, active layer; in Red, poly layer; in Blue, PVband of the poly layer.

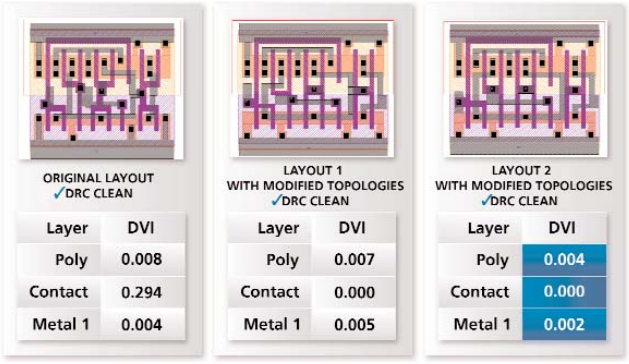
LFD Process Kit

To make LFD data accessible and intuitive to a designer, a "LFD kit" is provided that encompasses energy and dose considerations, RET recipes, process models and parameterizable rules to be checked. This is presented in a common check results database where the flow or sequence of tasks is in ASCII format. The library of elements invocated by the flow are compiled and mostly likely encrypted to protect the foundry's manufacturing recipe and model IP. Designers can use a layout viewer/editor and a results viewing environment, such as Calibre® RVE or Calibre® DESIGNrev, to view the check results and variability databases.

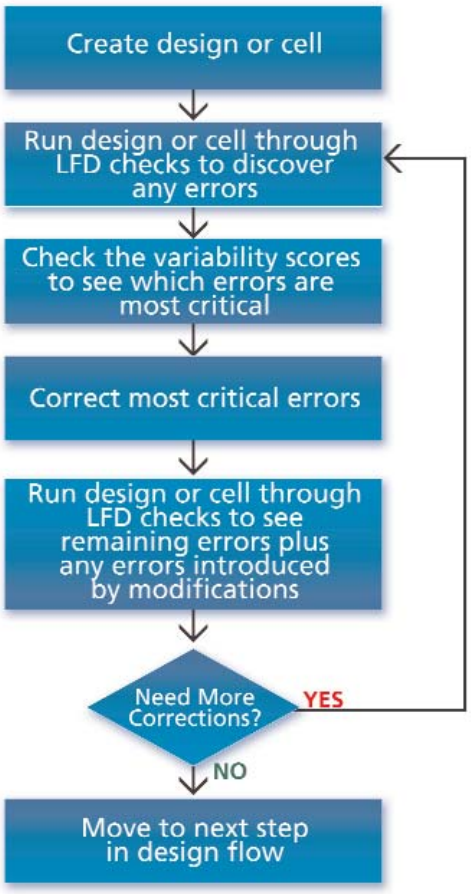
With this LFD kit, designers can run simulations to see how their layout will print under a particular lithographic process window. The simulation results can include recommendations about areas in which modifications would be most likely to improve yield. Designers can then make modifications to the layout in their native layout environment, much in the way design iteration loops are done now.

Design Variability Index (DVI™)

Calibre LFD also provides an index from which the layout designer can make trade-off decisions. This Design Variability Index, or DVI™, captures variability in order to make the design more robust to process variations; its goal is to try to lower the value. The flow or methodology will use this index created by LFD to compare different layout implementation and to select the one with the least variation.



The Design Variability Index (DVI™) provides data that helps the layout designer make decisions about which configuration makes the design more robust to process variation.



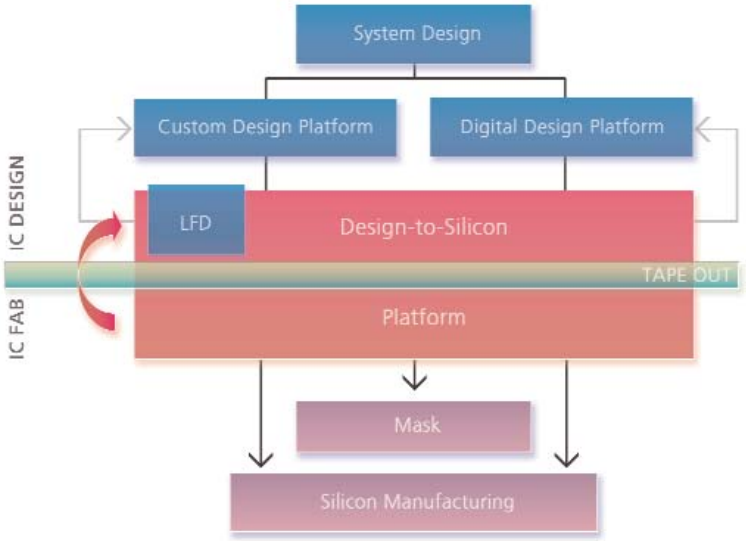
Calibre LFD in the Design flow

Calibre LFD data is presented in a manner that can be easily incorporated into the designer's layout and flow. It plugs into a flow much like an iterative design step, using the same layout editor used for the initial design.

The Calibre LFD kit will contain the details pertaining to pattern transfer at the foundry, including OPC, but only the effects of the processes are shown to the designer. Simulation information will be presented much in the way DRC rules are presented now, with data that can be classified and sorted within the design environment. The data will also include comments for possible solutions.

As designers become used to working in LFD mode, they will learn what design elements will respond favorably to manufacturing processes. In time, users will be designing in preventive mode; that is, naturally practicing manufacturing process-aware design. The goal of achieving a “DRC clean” design will transform into a goal of achieving a “DRC and LFD clean” design.

The industry standard Calibre platform from Mentor Graphics offers a complete solution that bridges design and manufacturing and provides a data communication link that is crucial to improved yield and reliability in nanometer IC designs. Fueled by a single, powerful polygon processing engine, the Calibre suite includes physical verification, parasitic extraction, resolution enhancement, mask data preparation and design for manufacturing tools.



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11-2005 MGC 1023940-w