Silicon Lifecycle Management Family

Improving silicon health and operational metrics at each phase of the device lifecycle

www.synopsys.com/slm
Synopsys SLM Family

The Synopsys SLM family is designed to improve silicon health and operational metrics at every phase of the device lifecycle. SLM is built on a foundation of in-chip monitor IP, data analytics and design automation. Environmental, structural and functional monitors enable deep insights from SoC manufacturing to in-field systems. Meaningful data is gathered at every opportunity for continuous analysis and actionable feedback.

Actionable Insights Through Silicon Lifecycle Monitoring and Analytics

Margin Optimization  
Silicon/Design Correlation  
Implementation Automation

Yield Optimization  
FA Candidate Prioritization  
Fab-Fabless Collaboration

Silicon Insights  
Improved Yield & Quality  
Cost Optimization

Power Optimization  
Predictive Maintenance  
Silicon Health

In-Chip Monitors  
In-Design  
In-Ramp  
In-Production  
In-Field

Design Analytics  
Manufacturing Analytics  
In-Field Analytics

Data Store  
Cloud, On-Prem, Edge, Embedded

Vision

Silicon Lifecycle Management (SLM) is an essential aspect of any advanced SoC based system today. Optimal silicon cost, quality, health and performance can only be achieved through continuous in-chip monitoring and analytics.
SLM Monitor IP

The Synopsys SLM family is built on a foundation of monitor IP. They are classified as: environmental, structural and functional monitors. They gather relevant data throughout the silicon lifecycle.

PVT Monitors

Process, Voltage and Temperature (PVT) monitoring is critical for optimal operation and performance in today’s SoCs

- Maximizes performance, power, reliability
- Highly accurate, distributed monitoring throughout the die
- Available on process nodes from 28nm to 3nm

Path Margin Monitors

Measure timing margin of actual functional paths in-test and in-field

- Monitor 1000+ synthetic and functional paths
- Optimize silicon performance based on actual margins available
- Automated path selection, IP insertion, and scan generation

Clock and Delay Monitors

Measure delay between edges of a signal(s)

- Clock duty cycle quality check
- Memory access time tracking with BIST
- Digital delay line test characterization

Signal Integrity Monitors

Measure signal quality of die-to-die interconnects (UCIe, HBM, …)

- Granular delay elements for accurate measurement
- Distributed architecture with low overhead for scan
- Automated EDA flow with UCIe, HBM interfaces

High Speed Access & Test

Enable testing over functional interface (PCIe, USB, SPI, …)

- Used during In-Field operation as well as WS, FT, SLT
- Supported by instruments from leading ATE providers
- Reduced pin count & test hardware saves cost
SLM Production Analytics

SLM Production Analytics (SPA), is an analytics solution unifying the design and manufacturing analytics lifecycle phases. SPA provides the ability to process and analyze petabytes of silicon data. It automatically highlights silicon data outliers, enabling engineering teams to quickly identify and correct underlying issues in the semiconductor supply chain.

SPA leverages silicon design, sensor, fab, diagnostic and production data across the different phases resulting in improved chip production metrics such as yield, quality and throughput, as well as key operational metrics such as chip power and performance.

- **Scalability**
  - Petabytes of data
  - Multi domain support
  - Cloud enabled

- **Productivity**
  - Actionable insights out-of-the-box
  - Automated root cause analysis
  - Accurate FA candidate selection

- **Efficiency**
  - Power and performance optimization
  - Quality, yield, throughput optimization
  - Real-time production control

SLM In-Field Analytics

Once a device is deployed into the field it is essential that it is continually monitored, tested, analyzed and potentially adapted. On-chip or Cloud based analytics can be used for predictive maintenance, aging identification, and fault detection in order to mitigate the risk of catastrophic system failures.

Monitor data can also enable real-time analytics and optimization schemes, such as Adaptive Voltage Scaling (AVS) resulting in lower power and extend device lifetime.

Finally, cloud based analysis of data from design, manufacturing and in-field provides powerful insights into the health of a fleet of devices, enabling better informed decisions to address root cause analysis for traceability and RMAs.

SLM & Test Synergy

Synopsys SLM and Test solutions encompass integrated tools, IP and methodologies to test, monitor and analyze SoCs, providing actionable insights at every phase of the device lifecycle.

These innovative test and analytics tools enable a unified flow that is securely connected to Synopsys' Fusion Design Platform for deep insights, from in-design to in-field, meeting design, test, and operational goals concurrently for the entire lifespan of a silicon device.
SLM Use Cases

Below is a selection of some of the popular SLM customer use cases:

- **Design Optimization**: Silicon to design calibration
- **Logic & Memory Test and Repair**: Sensor aware testing
- **Product Yield and Operational Efficiency**: Data fed forward and backward
- **Product Quality and Reliability**: IP, analytics & cloud integration
- **Multi-Die IC Monitor, Test & Repair**: Signal quality measurement
- **In-Field Management**: AVS, Predictive Maintenance & Traceability

SLM Established Tool Solutions

The Synopsys Silicon Lifecycle Management Family includes multiple integrated products and capabilities. The key components of SLM are highlighted below: