VarMan

Variation-aware Design Solution

VarMan™ comprises a comprehensive suite of analysis tools that allow the designer to accurately address statistical design variations and to make the right design decision upfront. VarMan relies on advanced machine learning approaches with advanced statistical algorithms and sampling strategies.

Key Benefits

- Breakthrough analysis techniques: Impressive simulation time speed-up

- Simulator and environment independent: Supports all golden SPICE simulators and design environments

- Reliable and mature technology: Tested and validated by major players on most advanced technology nodes (FinFET, FDSOI)

- Smart simulation manager: Simulation results management and high simulation throughput through LSF/SGE/Slurm cluster

- User-friendly GUI: Fast and easy-to-use 'load and analyze' use model

Fast Monte Carlo Analysis

The innovative approach VarMan uses for Monte Carlo analysis has been designed to provide equivalent results to a classical Monte Carlo analysis, but with up to a 30X speedup.

Application:

- VCO, 28nm Bulk CMOS, 1,800 devices, and 1,900 parasitics

- Requested MC equivalent runs: 50,000
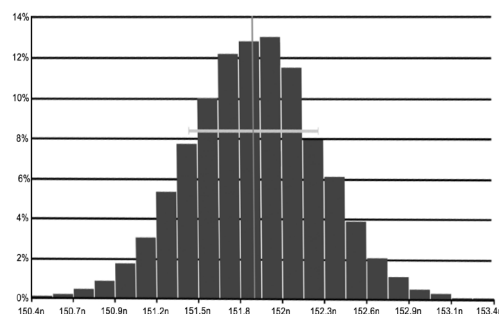
FMC	# Runs	Runtime (h)
SPICE	50,000	1475
VARMAN	587	21
Speedup	85x	70x

High-Sigma Performance Limits

Given the required sigma (yield), this analysis will find the design performance limits that correspond to this yield. The analysis is very economical in the number of simulations and robust to multi-failure zones.

Application:

- SRAM bitcell, FinFET process

- 5.2 sigma estimation
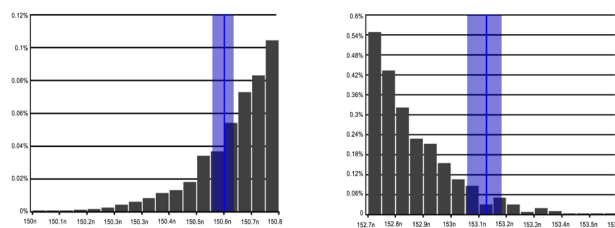
Yield Estimation	Read Current		
	# Runs	Icell (µA)	Speedup
Quantile 1/10M	100M	6.85	5,000x
VARMAN	20k	6.84	

High-Sigma Yield Estimation

Given a design performance limit, this analysis will quickly verify and estimate the yield to 4-6+ sigma with a very limited number of simulations. It captures the process configurations that trigger parametric failures to accurately estimate the yield and to predict extremely rare events.

Application:

- RAM bitcell, 28nm CMOS

- 5.4 sigma – the equivalent of 930M MC runs
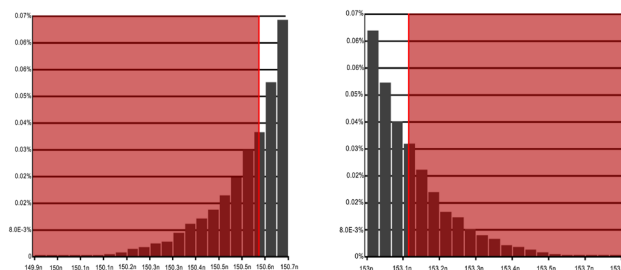
| Yield Estimation	# Runs	Detected fails	Sigma	Speedup
Monte Carlo	100M	1	5.43	36,000x
VARMAN	26k	13591	5.42	

High-Sigma Spread

High Sigma Spread (HSS) generates a complete view of a cell yield in one operation, exploring sigma from low to high, to ensure a design with best power, performance, and area.

HSS is robust for non-linearity and non-gaussian distributions, commonly seen in advanced process technology nodes.

Application:
SRAM cell bitcell

- Measure: Write Margin
- Corner: -40 degC
- Yield: -6 to +6 sigma
- No. of equivalent runs: 54k
- 2 Licenses, 2 CPUs
- Analysis time: 11 min
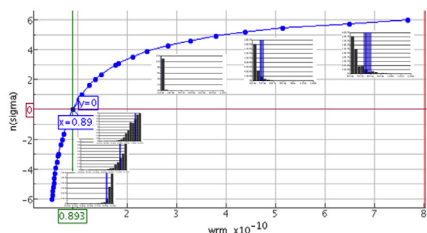
Variability eXplorer Analysis

Exploring design performance critical zones, Variability eXplorer (VX) will identify marginalities from 3-sigma to high-sigma. Highly cost effective, providing variability induced marginal corners and most influential parameters.

Application:

- Sense Amplifier, 28nm FDSOI
- Target 5.2 sigma equivalent to hundreds of millions of MC runs
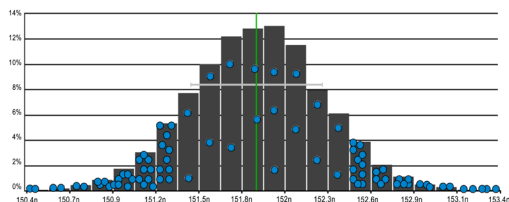
Variation Manager/n_σ	4.5σ	5.2σ
VX TIME (H)	3.76	3.93
# Runs	1k	1k
# Fails	8	184
usl@ n_σ (mV)	35	40

True Corners Extraction

VarMan True Corners Extraction investigates the PVT parameters that lead to the performance most likely to achieve a given yield. Compared to the long verification time of the huge number of PVT corner combinations, this analysis drastically reduces simulation runs to only the essential true corners of the design.

Application:

- 90nm Embedded Flash, 1,100 devices
- Targeted 3 sigma and 4 sigma corners
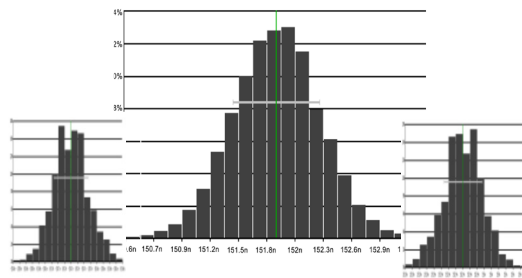
True Corners		3σ	4σ
SPICE	# Runs	142k	6M
	Time(h)	457	19,000
VARMAN	# Runs	422	559
	Time(h)	2.9	4
Time speedup		158x	4700x

VarMan Utilities

VarMan offer different utilities for more efficiency:

- VarMan Bench triggers multiple runs to explore different temperature, sub-circuit, parameters values
- VarMan DK Qualifier for efficient Design Kit support
- VarMan Calculator to visualize and understand sigma vs equivalent MC with confidence Interval

Product Analysis Summary

Features	VarMan Analog	VarMan Library	VarMan Memory	VarMan Memory + XMA Option*
Variability eXplorer Analysis	•	•	•	•
Fast Monte Carlo Analysis	•	•		
True Corners Extraction	•			
Local Variability Analysis	•			
High-Sigma Performance Limits		•	•	•
High-Sigma Yield Estimation		•	•	•
High-Sigma Spread			•	•
XMA MC*				•
XMA XFail Analysis*				•
XMA Yield Verification*				•

More information on VarMan XMA analyses, can be found in the VarMan XMA option product brief.