

SpiceCut-Memory

Critical-Path Circuits Generation for Simulation and Verification

“Legend’s MemChar and SpiceCut have enabled us to **accurately characterized** more than a **thousand of memories** from our compilers.”

Steve Crain, Director
BroadCom Corporation

“MemChar provide us not only the ‘**true**’ **setup and hold time**, but also the **automated flow**.”

LeeChung Yiu, VP
Marvell Semiconductor, Inc.

“VIA has selected Legend’s MemChar and SpiceCut for memory characterization. We are impressed by the **automation, accuracy and performance** of Legend’s tools.”

Alan Liaw, CAD Director
VIA Technologies, Inc.

Legend Design Technology, Inc.

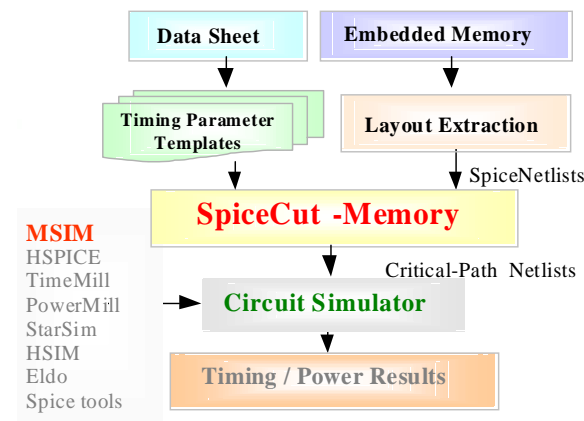
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Building ‘critical-path’ circuits to reduce simulation time has become very necessary, especially for characterization at multiple slew rates, multiple loadings and multiple PVTs. To characterize setup and hold time, only a small critical-path circuit is needed with measurement nodes for simulation, and full-circuit may not help.



MSIM is a characterization-oriented circuit simulator

Build ‘Critical-Path’ Netlist

- Creates a small equivalent circuit for Spice simulation (e.g. access time) by removing the redundancy and remodeling memory arrays
- Builds bi-section models for setup / hold time and minimum clock width
- Performs AWE RC reduction
- Provides circuit reduction for power analysis

Verify and Debug Circuit

- Verifies memory structure from layout-extracted netlist.
- Checks the decoder function by toggling all address patterns, and simulating them

- Locates worst and best word line by running Spice simulation on each pattern automatically, and,
- ERC analysis over entire chip

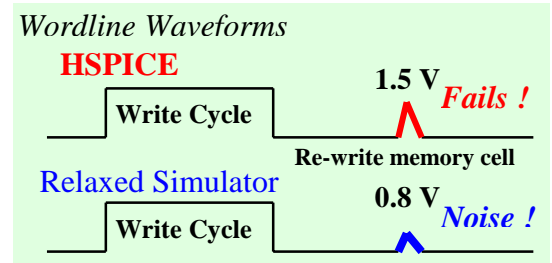
Locate Critical-Path of Memory

SpiceCut-Memory can exhaustively simulate all address patterns, automatically verify the corresponding wordline, and the timing from address change to wordline’s. The worst and best wordline can then be located, as shown below.

wadr0	wadr1	wadr2	wadr3	wadr4	wadr5	Word	Delay
0	0	0	0	0	0	F13712	1.80ns
1	0	0	0	0	0	F56432	1.82ns
...							
1	1	1	1	1	1	F34577	1.94ns
Worst-Delay Wordline							
1	1	1	1	1	1	F34577	1.94ns
Best-Delay Wordline							
0	0	0	0	0	0	F13712	1.80ns

Reliability Checking

SpiceCut-Memory builds ‘critical-path’ circuits, which are compatible to various simulators. The reliability can be checked by the sensitivity of simulators.



Benchmark

Critical-Path Circuit for ‘Access Time’

4K x 16 SRAM	MOS #	R#	C#	HSPICE Time
Original	408,536	4,538,131	1,753,873	N/A
After SpiceCut	11,044	19,205	7,736	27 Min