

Open Analog – DIAMOND Testbench (FREE)

Dual Mode (SCH + PEX) inverter characterization for IHP SG13G2 using ngspice-45.

1. What this is

A robust baseline testbench that runs DC, transient, and AC analyses across a small PVT set and writes a single CSV summary plus per-point RAW files.

2. Prerequisites

You need (a) ngspice 45, (b) a working SG13G2 PDK install, and (c) a .spiceinit that configures sourcepath so “cornerMOSlv.lib” resolves.

3. Quick start

- 1) Edit parameters at the top of tb_diamond_inverter.spice:
 - SIM_MODE: 0=SCH, 1=PEX
 - CORNER_IDX: 0=TT, 1=SS, 2=FF
 - VDD_NOM, CLOAD, and PULSE timing
- 2) Run:
`ngspice -b -o run_gold.log tb_diamond_inverter.spice`
- 3) Inspect outputs:
`results/summary.csv`
`results/run_trace.log`
`results/*.raw`

4. Output semantics

Each CSV row corresponds to one (VDD scale, temperature) point for the selected mode+corner. Pass/fail is computed from: DC VOH/VOL limits and timing limits.

5. Customizing to your DUT

- Replace the DUT .include paths (SCH and PEX).
- Keep a wrapper subckt that exposes a stable interface: VDD VIN VOUT VSS.
- Map the wrapper pins to your DUT's pin order inside XU_CORE.

6. Common failure modes

- A) "incomplete or empty netlist"
 - Ensure .control/.endc and .end exist.
 - Don't use both "-o run.log" and shell redirection at the same time.
 - Convert line endings to LF if edited on Windows.
- B) "redefinition of .subckt ... ignored"
 - Usually harmless; indicates duplicate model includes.
- C) PEX-only failures
 - Pin order mismatch. Use DUT_WRAPPER to standardize.

7. Intended extension (PRO ideas)

Automated corner sweep orchestration, plotting, aggregation, and multi-DUT templates are natural PRO extensions.