Influence of stimuli on the rising falling waveform timing

SIEMENS

Agenda

Motivation

Possible reasons for mismatch

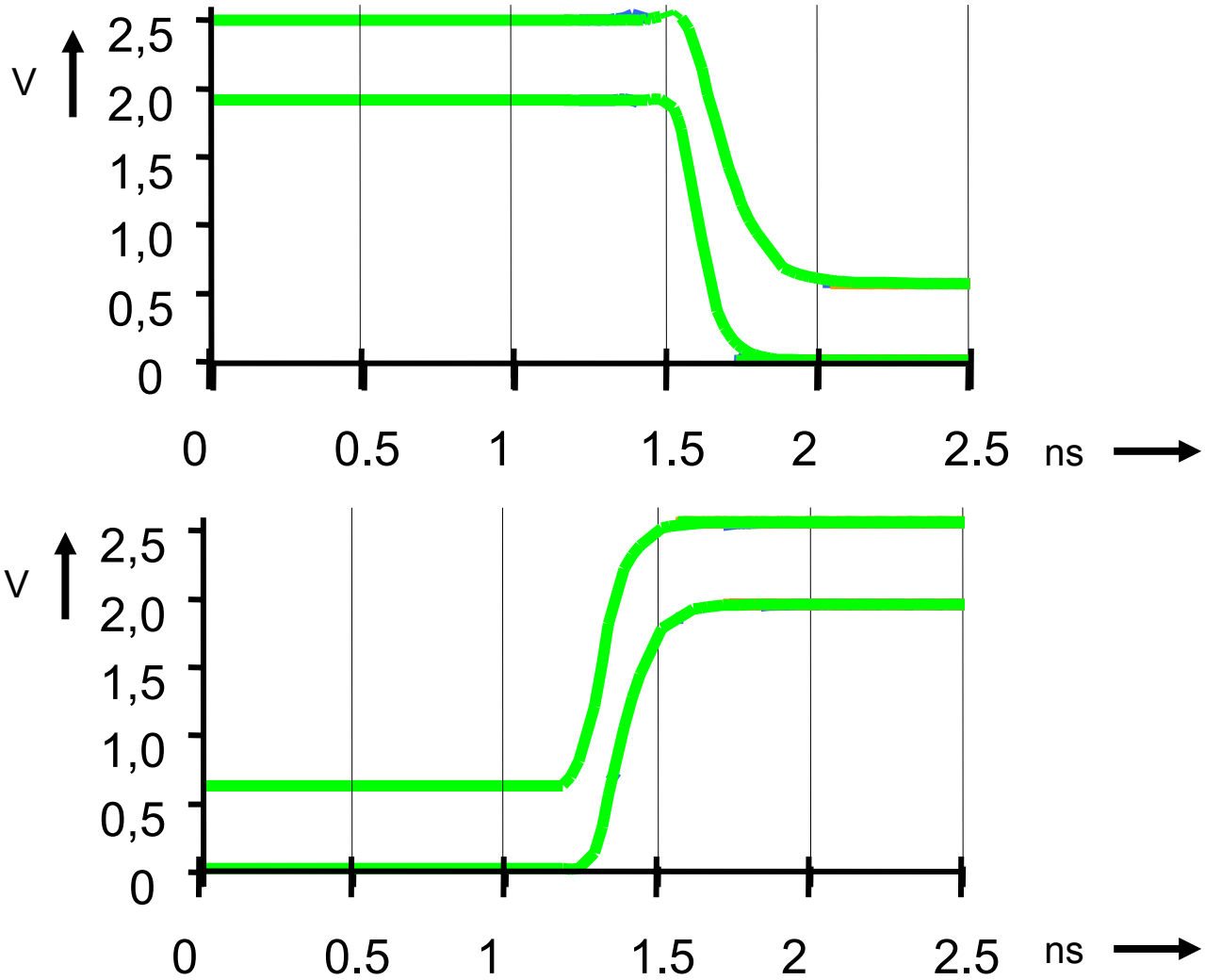
Investigation scenarios

First results

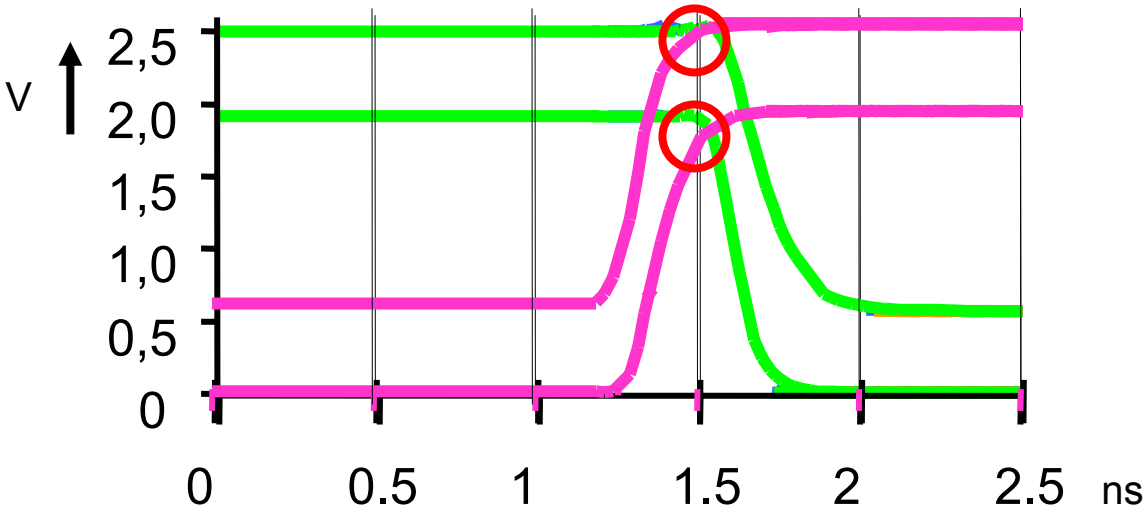
Operating frequency

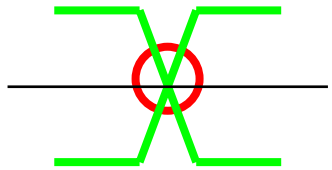
Summary

Single ended



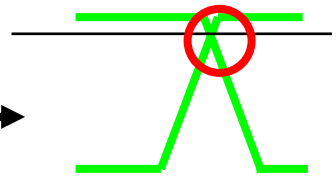
differential





Correct Crossing

For differential signal



Bad Crossing

For differential signal

Possible reasons for bad model

Wrong threshold for core

Wrong temperature range

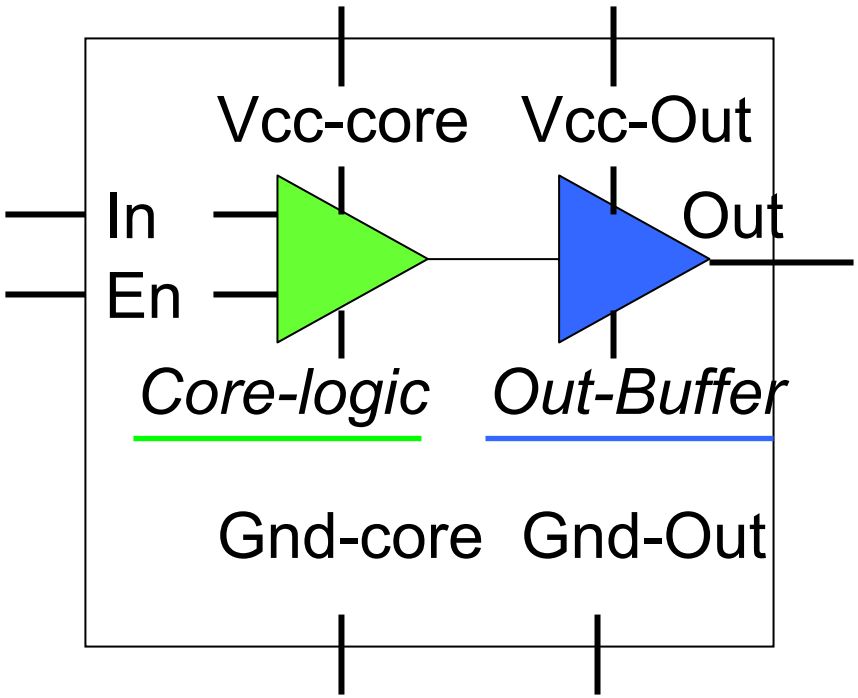
Wrong spice node description

Wrong spice node connections

Wrong extraction (wrong spice 2 ibis)

other

Spice subcircuit

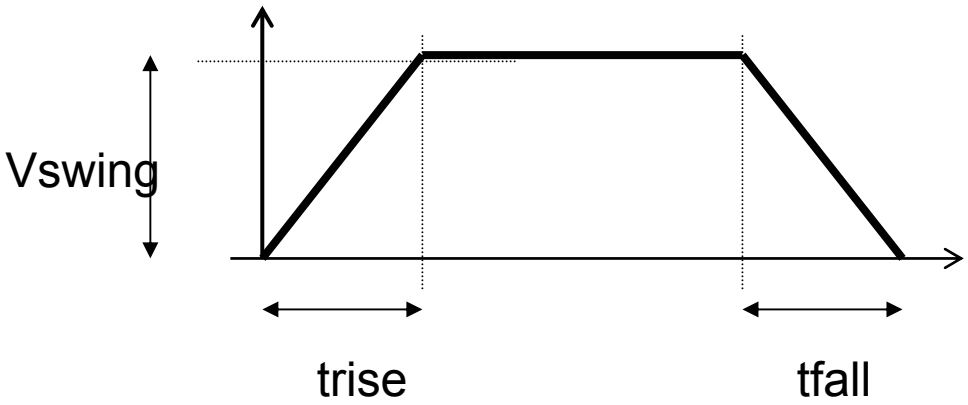


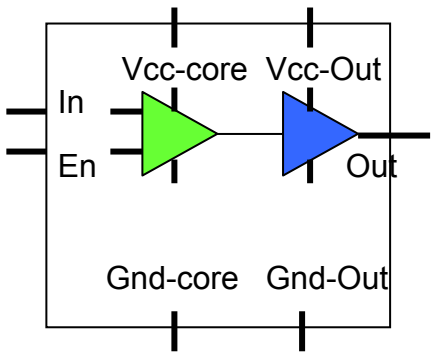
Cookbook definition

Cookbook definition

Internal driving waveform should be appropriate to the normal use of the device

Stimuli cases for core-input

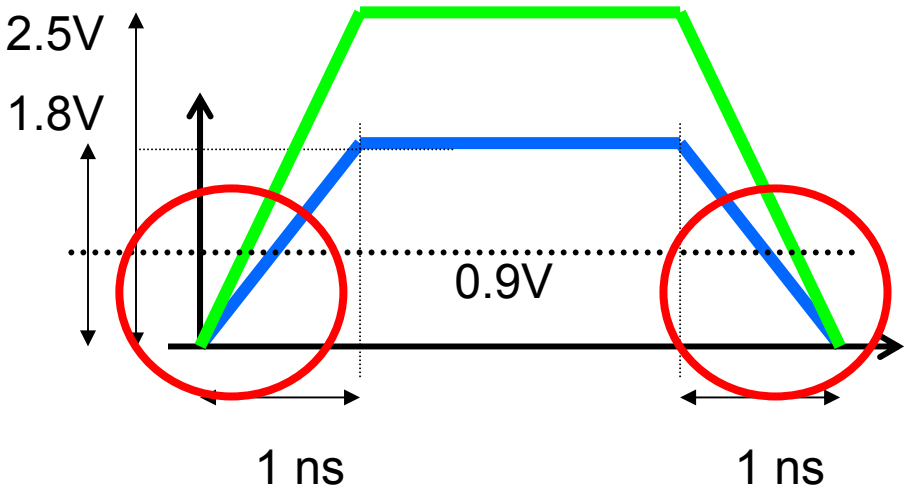




Case	Trise	Tfall	Vswing
1	1ps	1ps	1.8V
2	1ns	1ns	1.8V
3	1ps	1ps	2.5V
4	1ns	1ns	2.5V

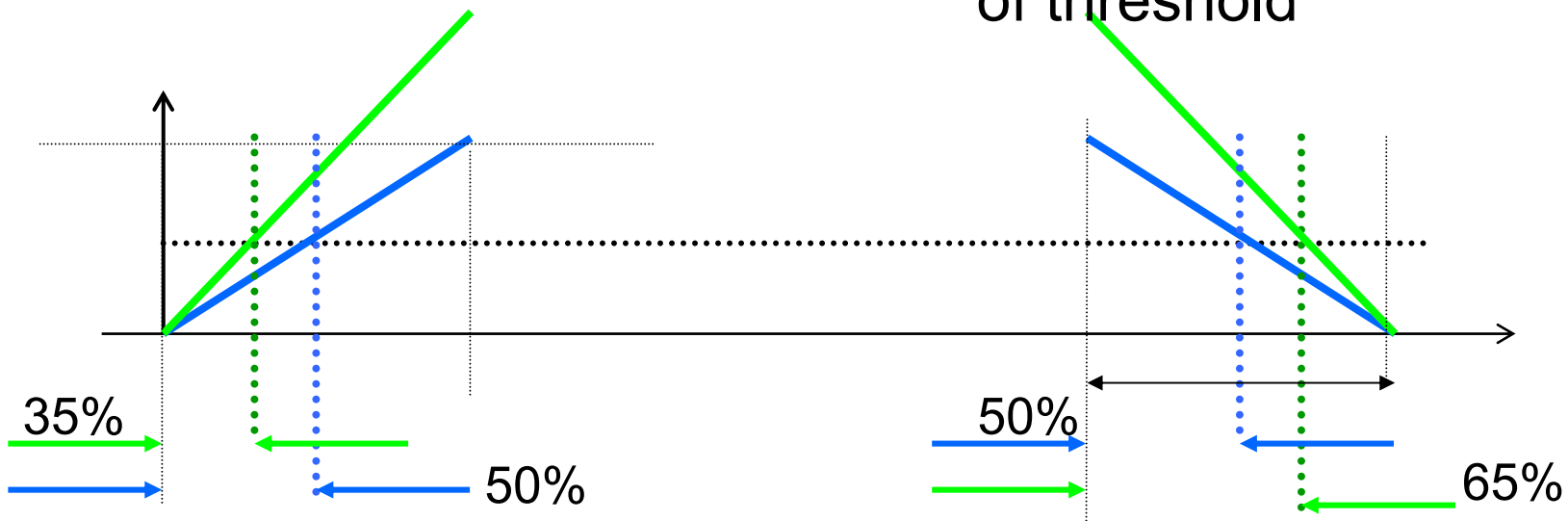
Vcc-core 1P8V // Vcc-Out 2P5V

Stimuli comparison for internal 1.8V Vcc-core

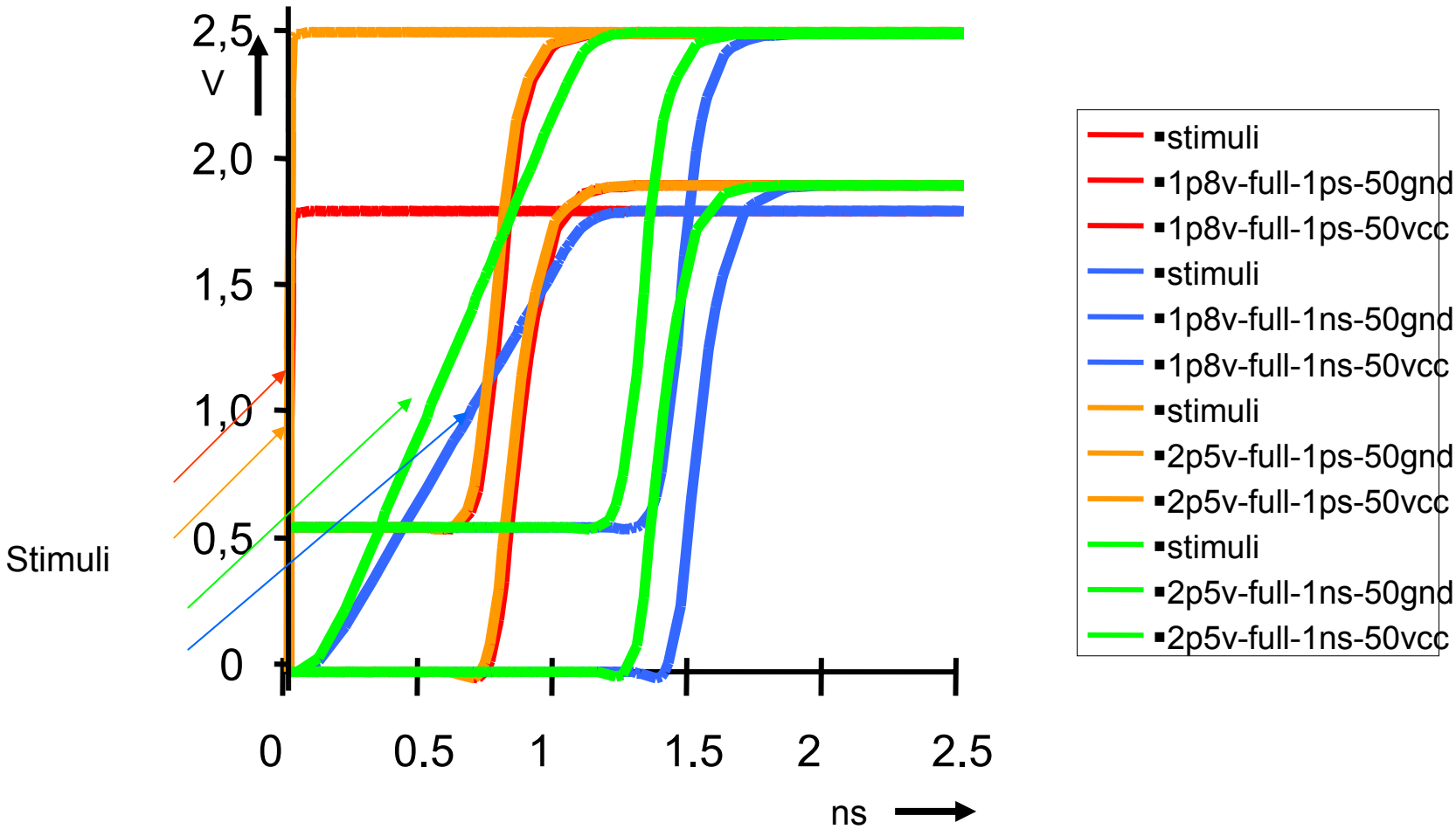


1.8V symmetrical crossing of threshold

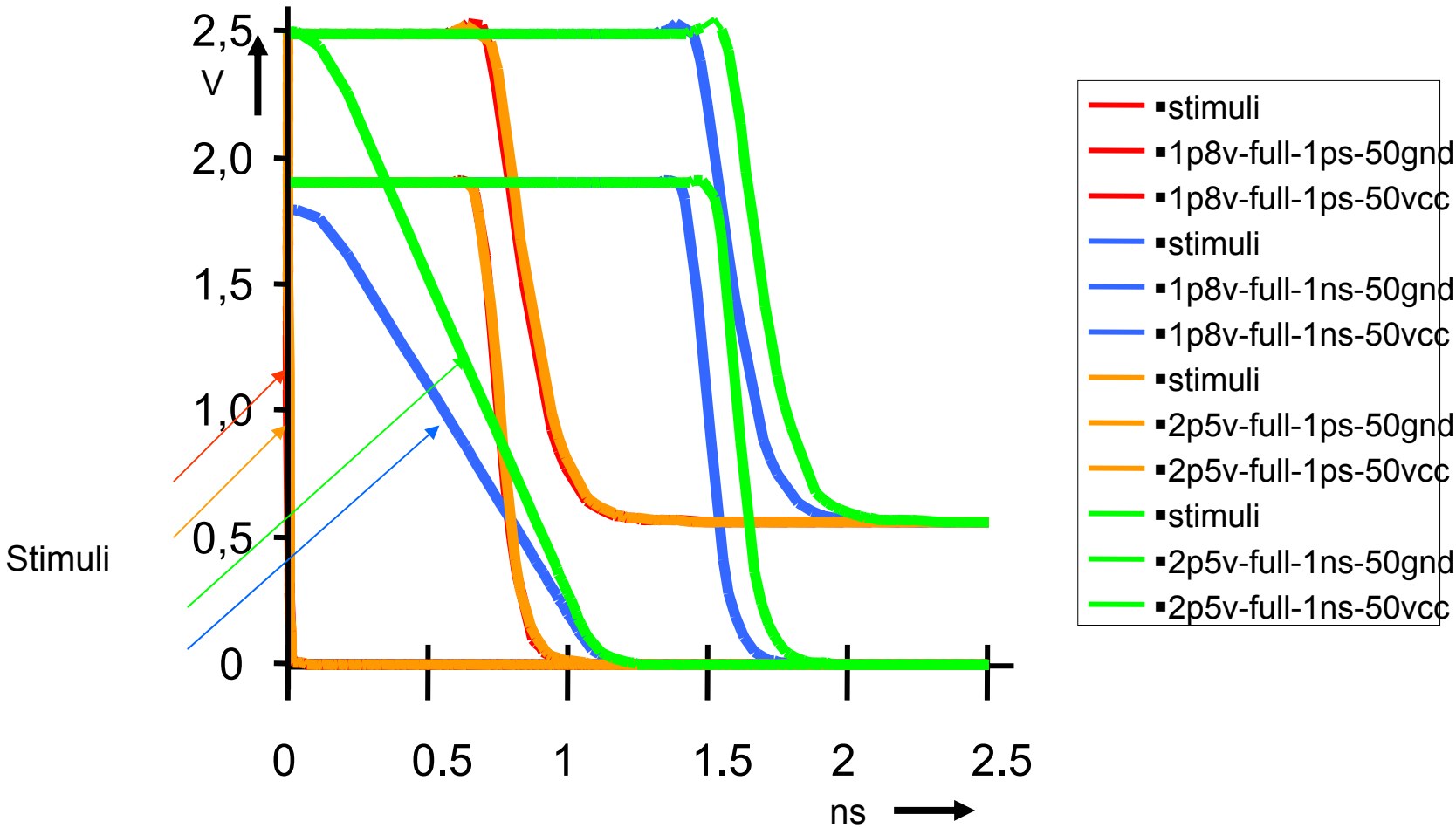
2.5V unsymmetrical crossing of threshold



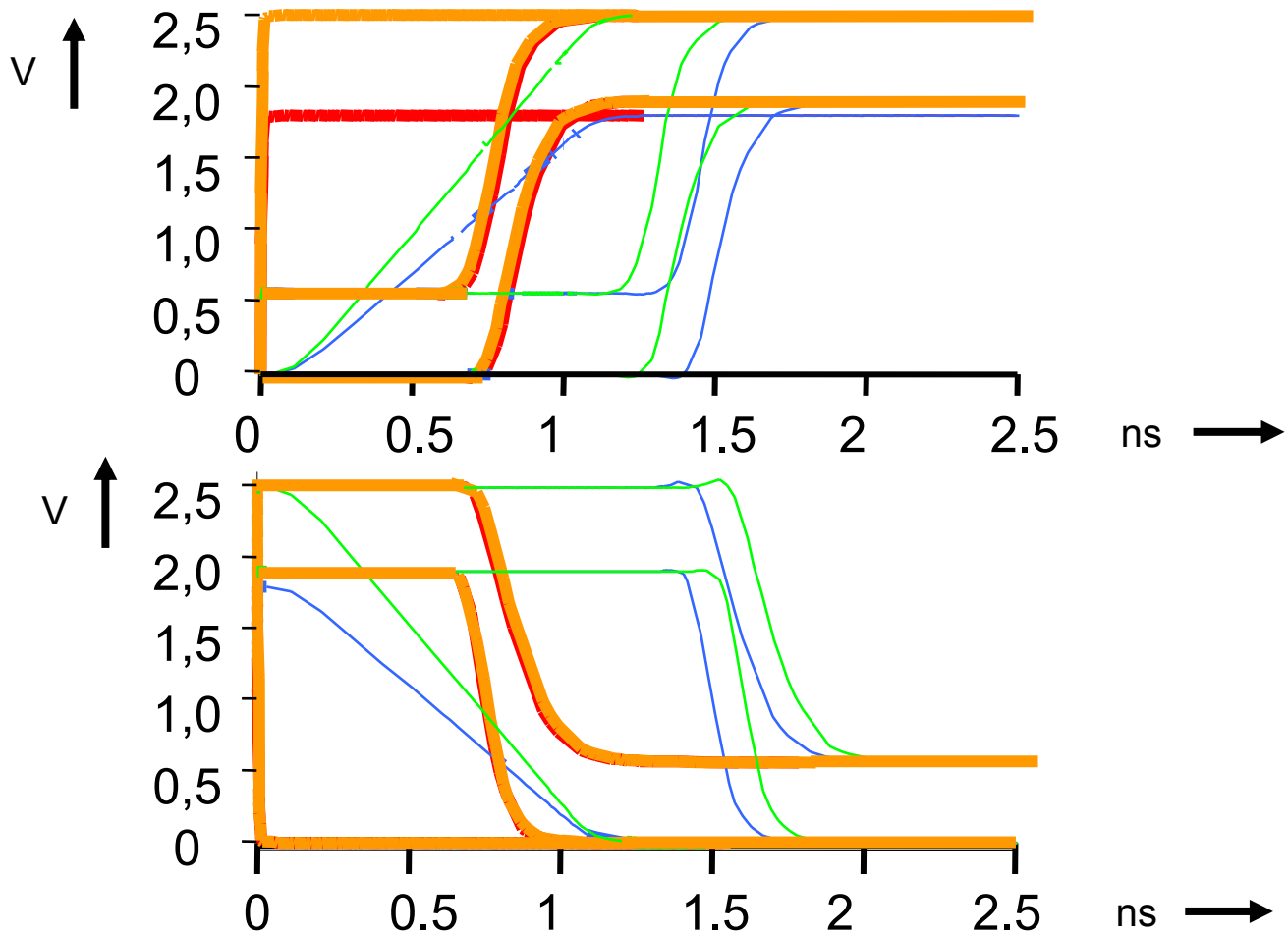
Rising waveforms



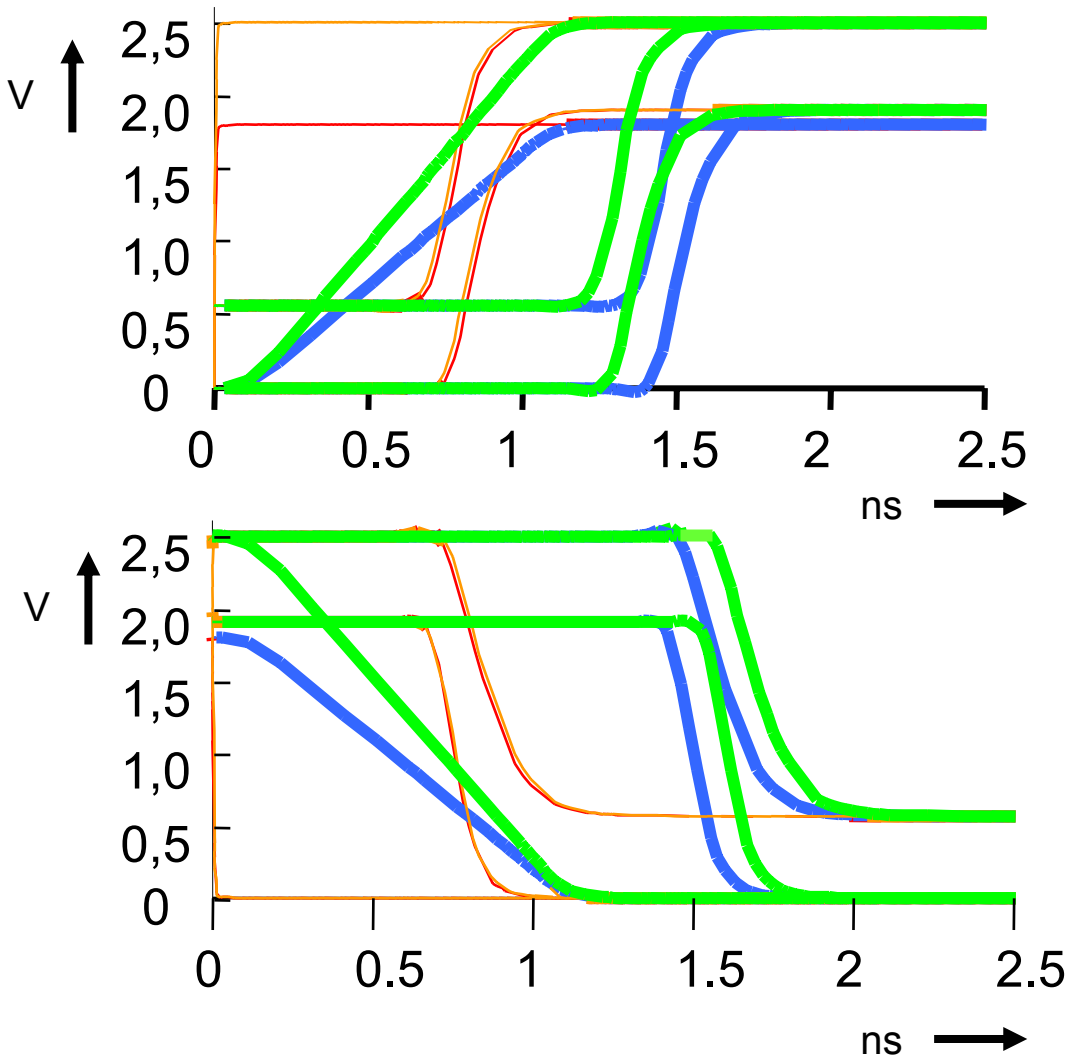
Falling waveforms



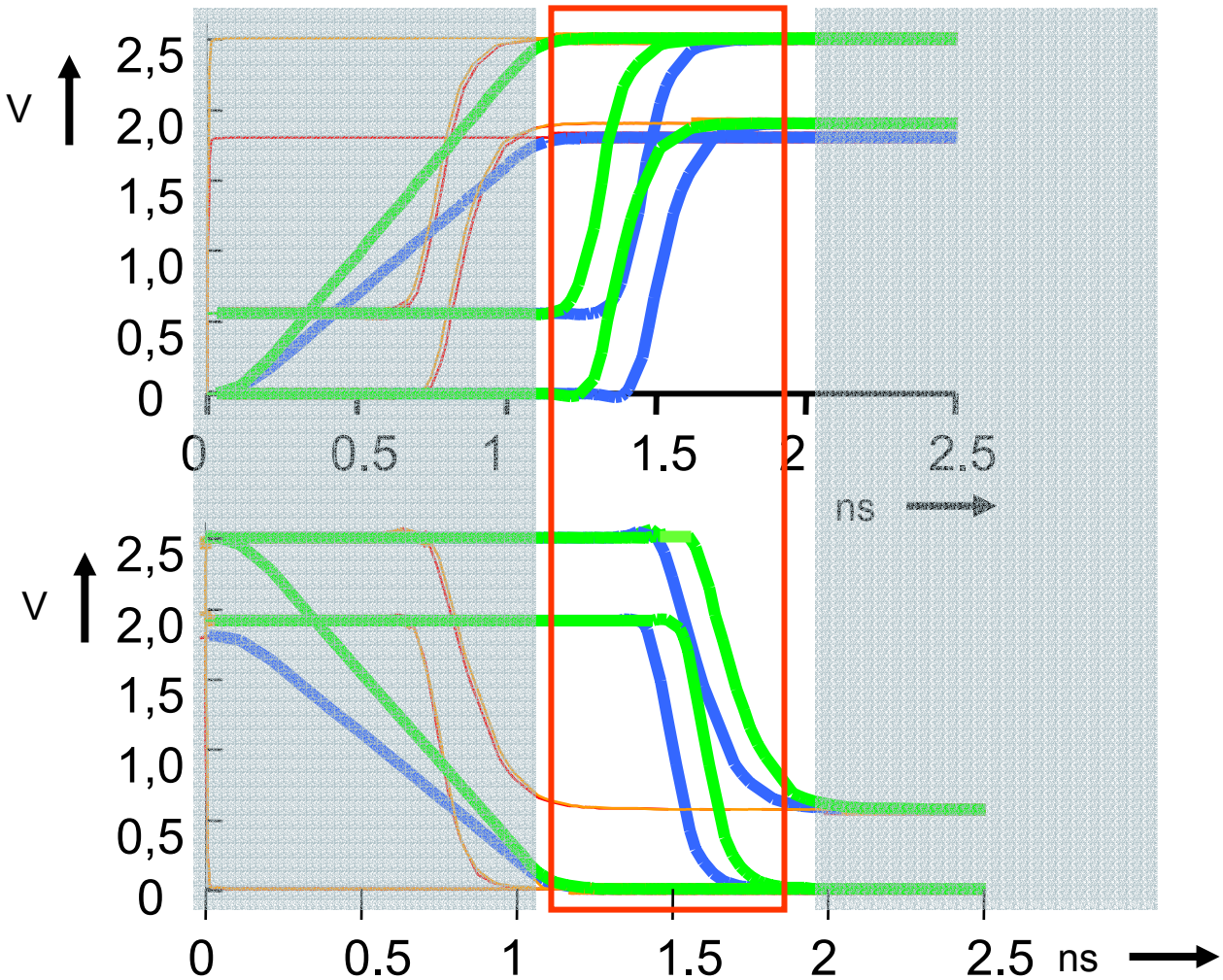
Comparison 1ps risetime and swing 1p8v—2p5v



Comparison 1ns risetime and swing 1p8v—2p5v



Closer Comparison 1ns risetime and swing 1p8v—2p5v



RISING:

Green curves

are starting

before the blue ones

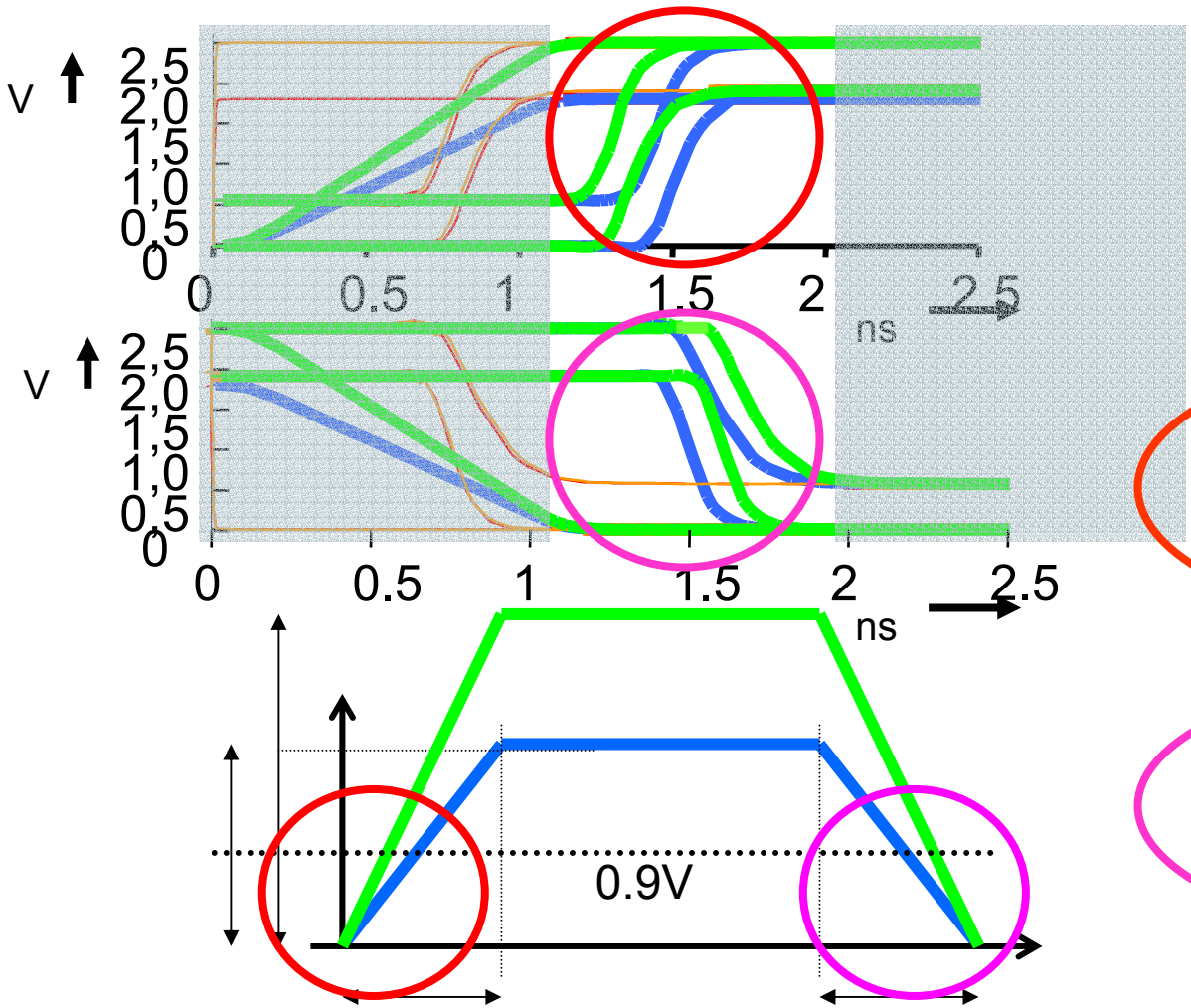
FALLING:

Green curves

are starting

after the blue ones

Very Close Comparison 1ns risetime and swing 1p8v—2p5v



Green curves

are shifted because :

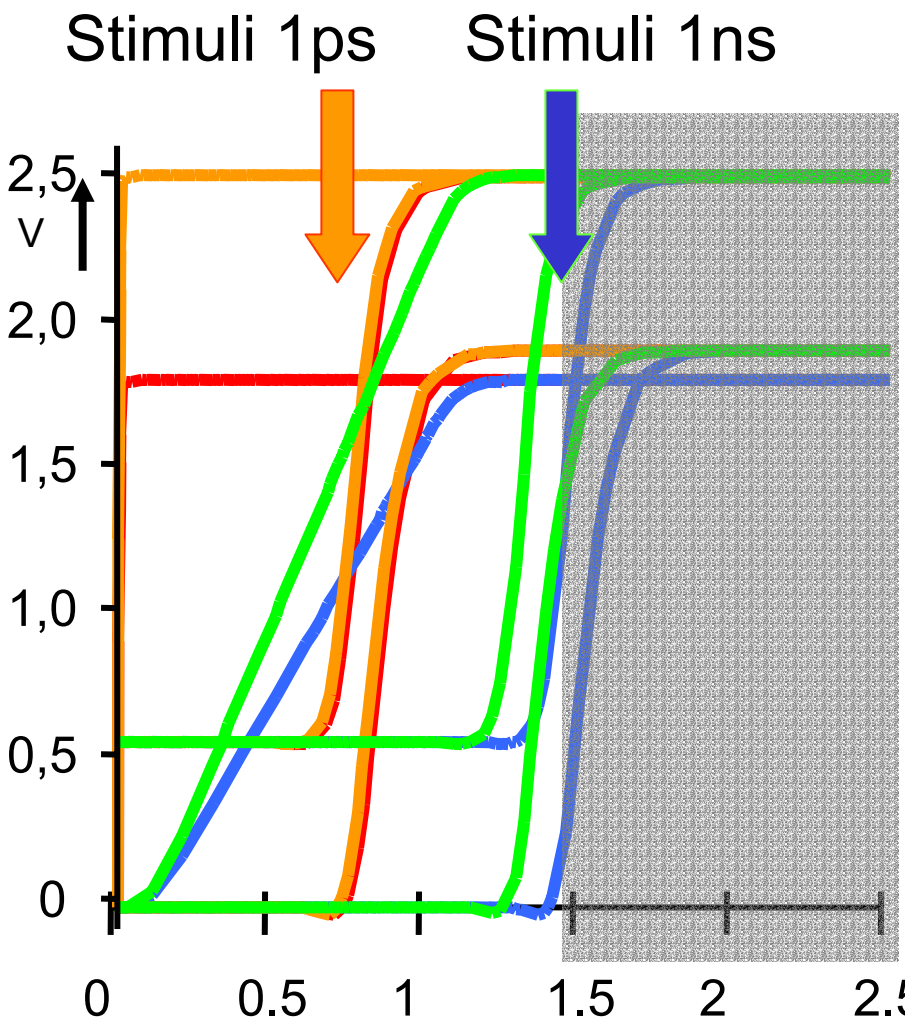
2p5V-swing reaches

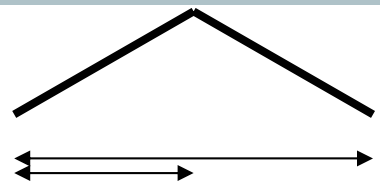
Threshold first for rising

2p5V-swing reaches

Threshold second for falling

Influence on operating frequency rising edge





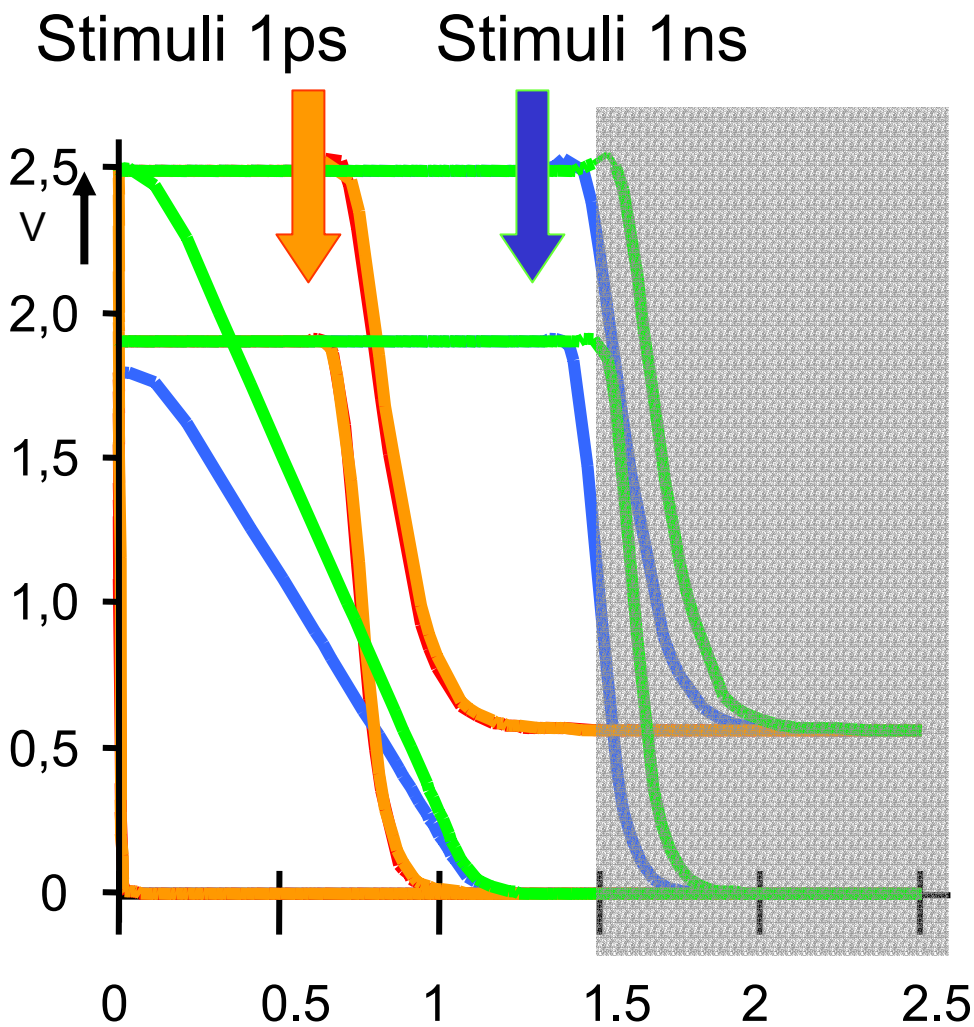
trise/tfall period

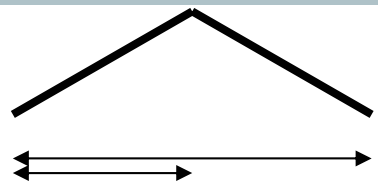
Frequency	trise/tfall
333MHz	1.5ns
200MHz	2.5ns

rising for model from

1ns-stimuli not finished

Influence on operating frequency falling edge





trise/tfall period

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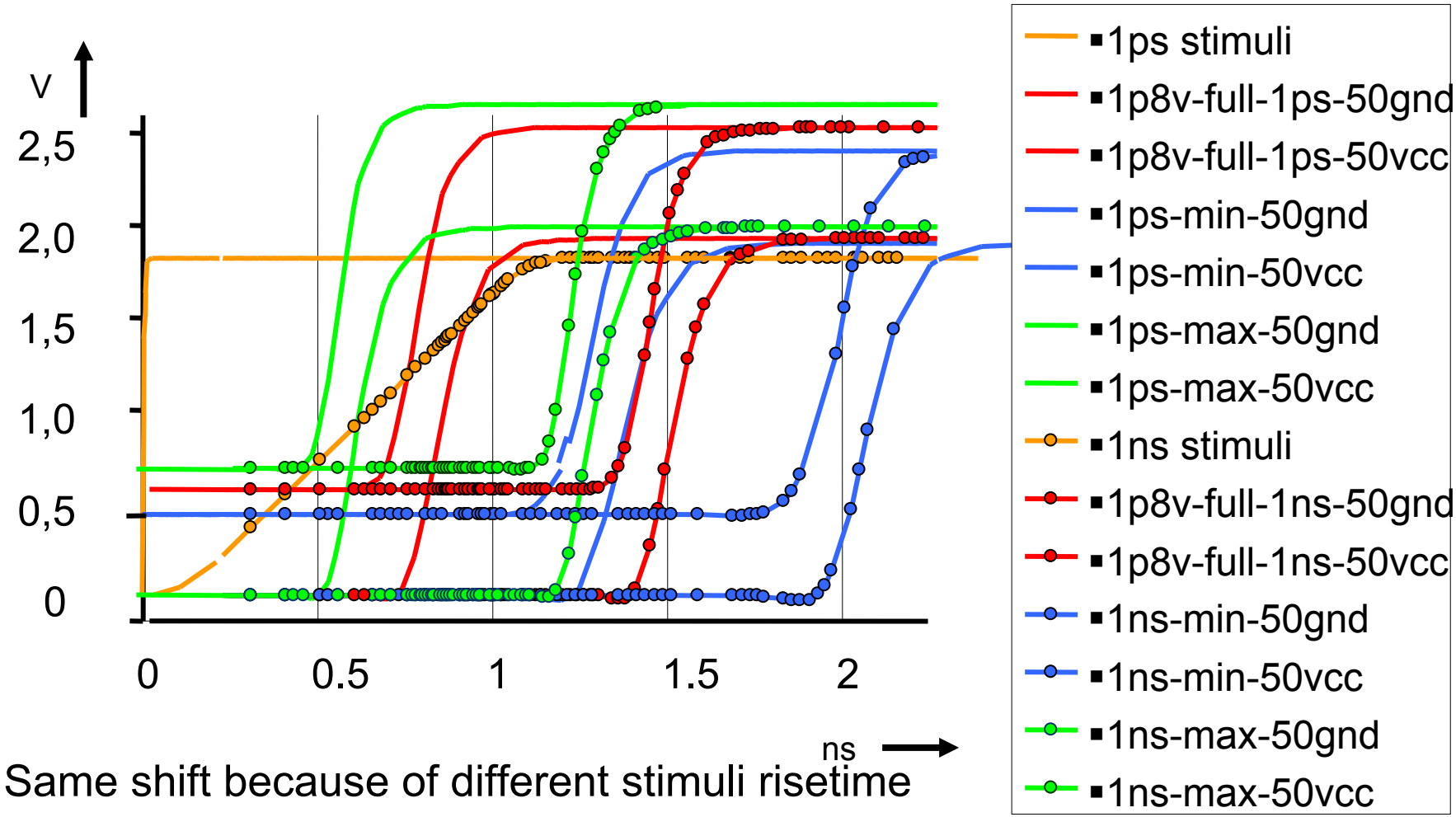
falling for model from

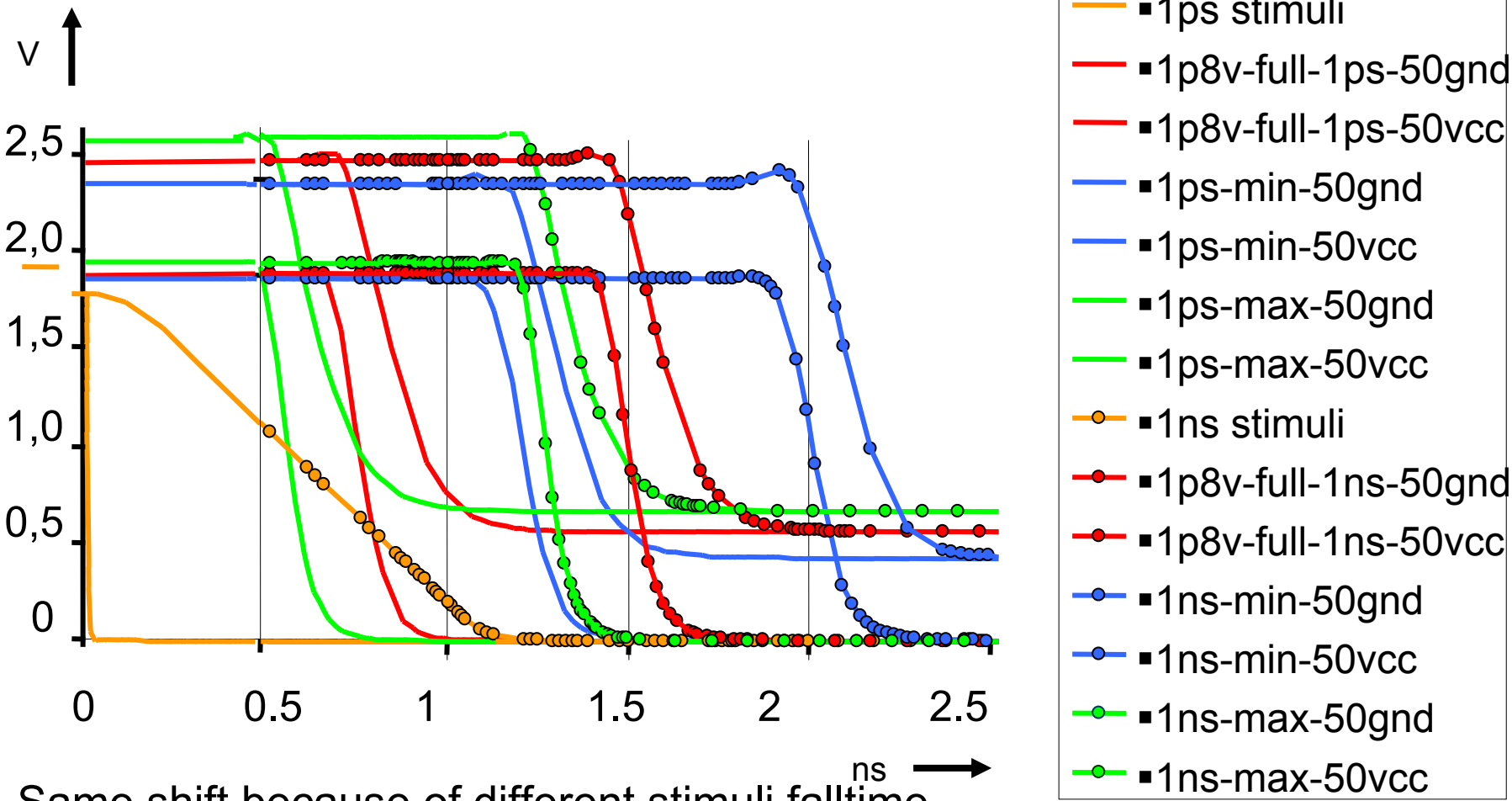
1ns-stimuli not finished

Rise Min typ max waveforms comparison 1p8V swing only



Same shift because of different stimuli risetime

Fall Min typ max waveforms comparison 1p8v swing only



Same shift because of different stimuli falltime

Some rules of thumb

Tr/tf stimuli << trisefall IO-buffer

Tr/tf ~ (dt_ramp / 100)

Tr/tf ~ Tperiod / 100
(333MHz => Tperiod = 3ns)

Use correct voltage swing

Use correct vcc-core / Vcc-IO combination

Summary

With 1ps stimuli risetime almost no difference in the created models

But 1ps is not always the correct time to use

For 10ns HCMOS even 1ns stimuli risetime is ok.

For a 250ps SSTL25/18 1ns is bad

Information about used stimuli is needed (e.g. like in the IMIC-model from JEITA)

Cookbook should be more precise about the stimuli