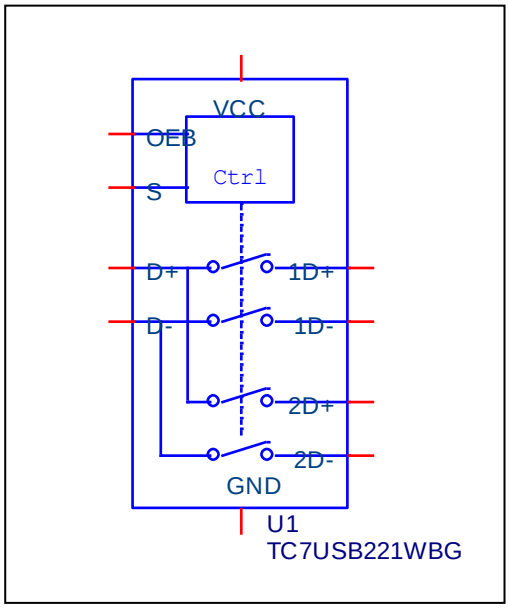
Device Modeling Report

COMPONENTS: USB Switch
PART NUMBER: TC7USB221WBG
MANUFACTURER: TOSHIBA

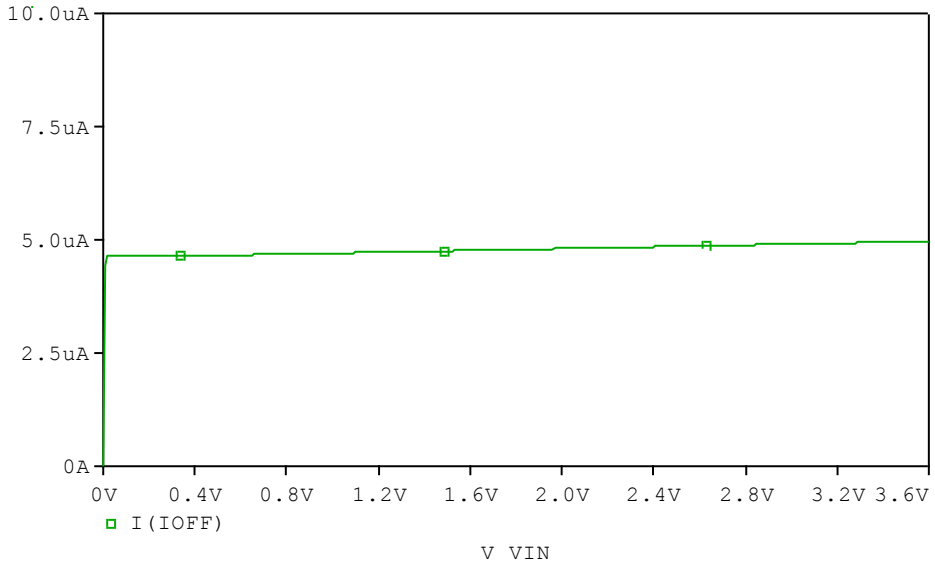
Bee Technologies Inc.

Circuit Configuration

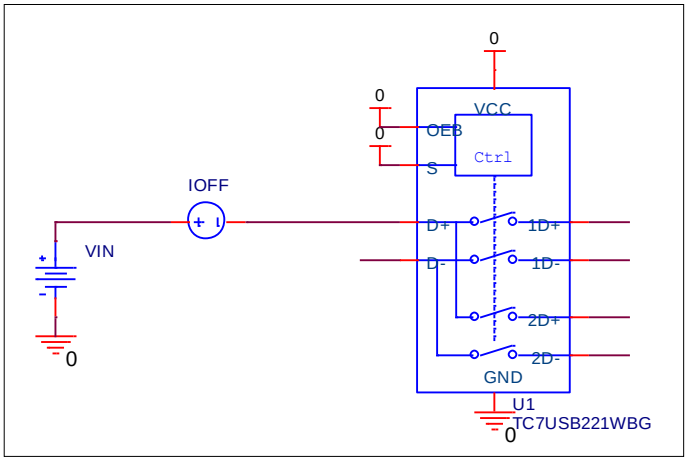


Power-Off Leakage Current Characteristics

Simulation result



Evaluation circuit



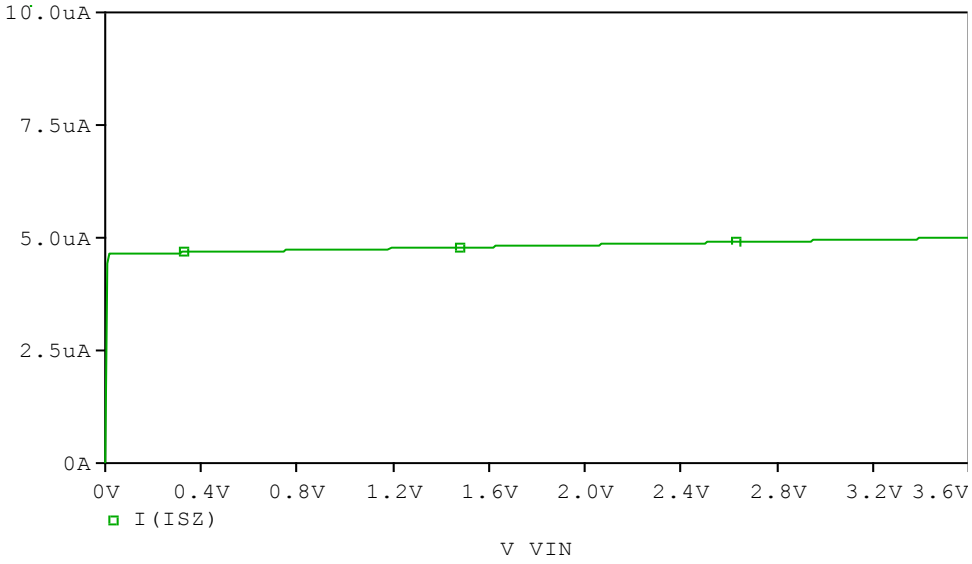
Simulation Result

Condition: V_{CC} = 0 V, V_{IN} = 0 to 3.6 V

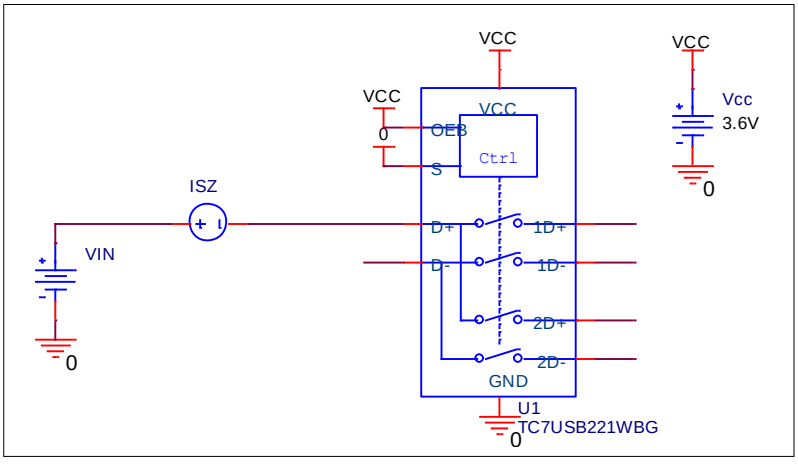
Parameters	Measurement	Simulation	%Error
I_{OFF} (uA)	**5.0**	**4.966**	**-0.68**

Off-State Leakage Current Characteristics

Simulation result



Evaluation circuit



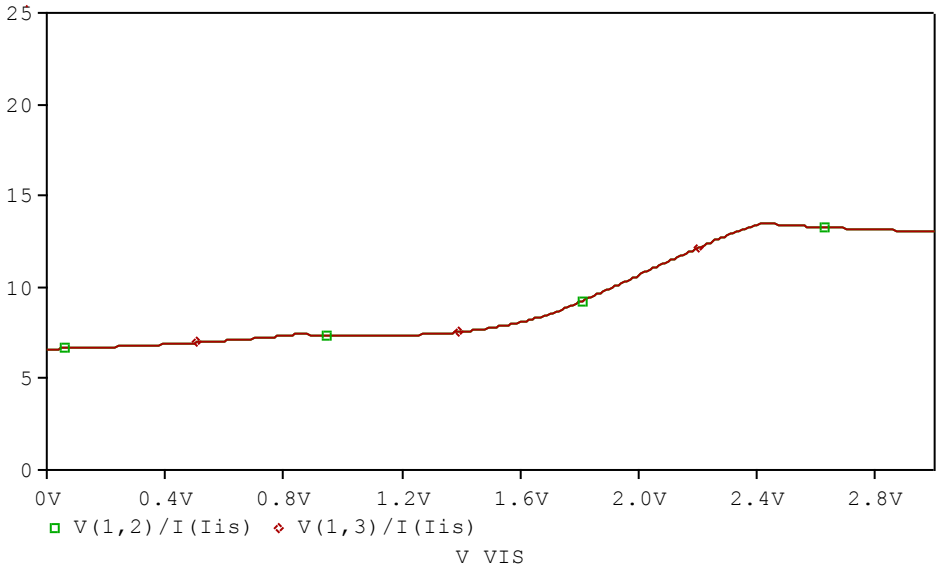
Simulation Result

Condition: V_{CC} = 2.3 to 3.6 V, VIS = 0 to V_{CC}

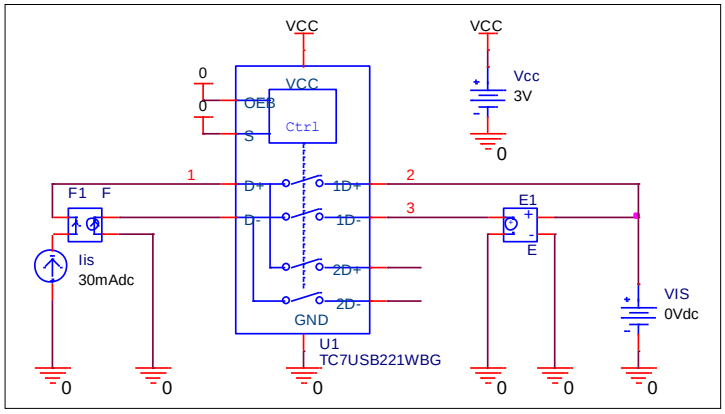
Parameters	Measurement	Simulation	%Error
I_{SZ} (uA)	**5.0**	**5.0**	**0**

ON Resistance Characteristics

Simulation result



Evaluation circuit



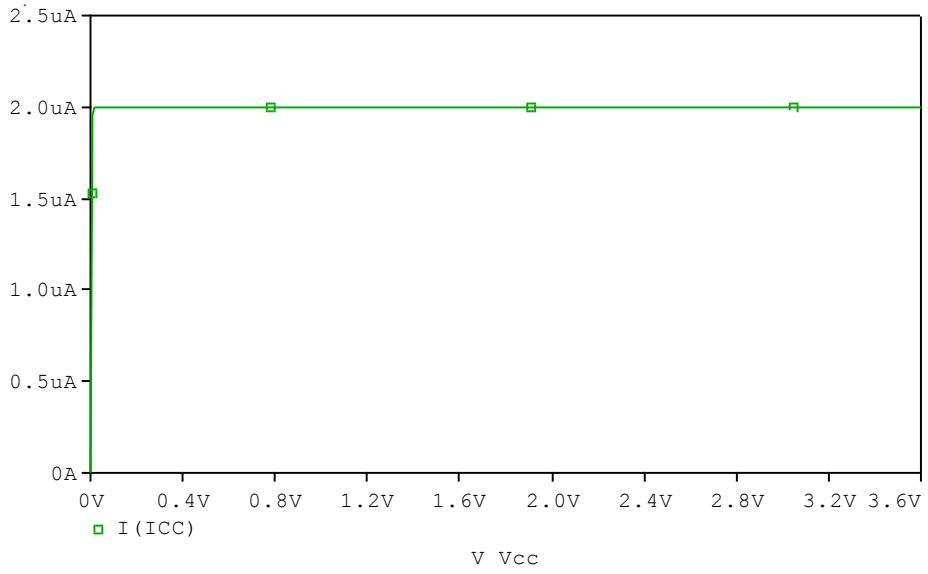
Simulation Result

Condition: V_{CC} = 3V, I_{IS} = 30mA to V_{CC}

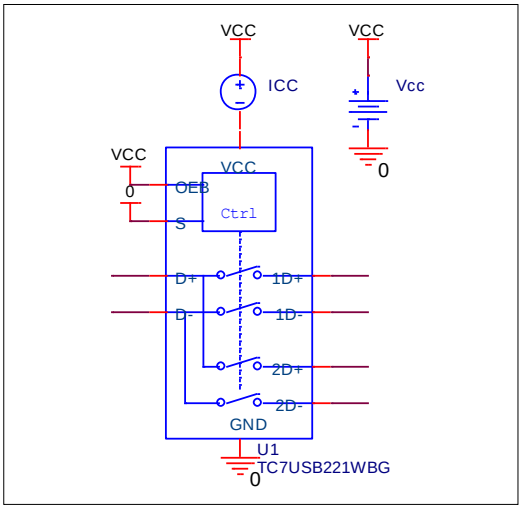
Parameters	Measurement	Simulation	%Error
R_{ON} (Ω) (V_{IS}=0V)	6.5	6.612	1.72
R_{ON} (Ω) (V_{IS}=0.4V)	7.0	6.867	-1.90
R_{ON} (Ω) (V_{IS}=3.0V)	13	13.034	0.26
R_{ON} (Ω) (V_{IS}=0.4V, 1V)	0.5	0.499	-0.20

Quiescent Supply Current Characteristics

Simulation result



Evaluation circuit



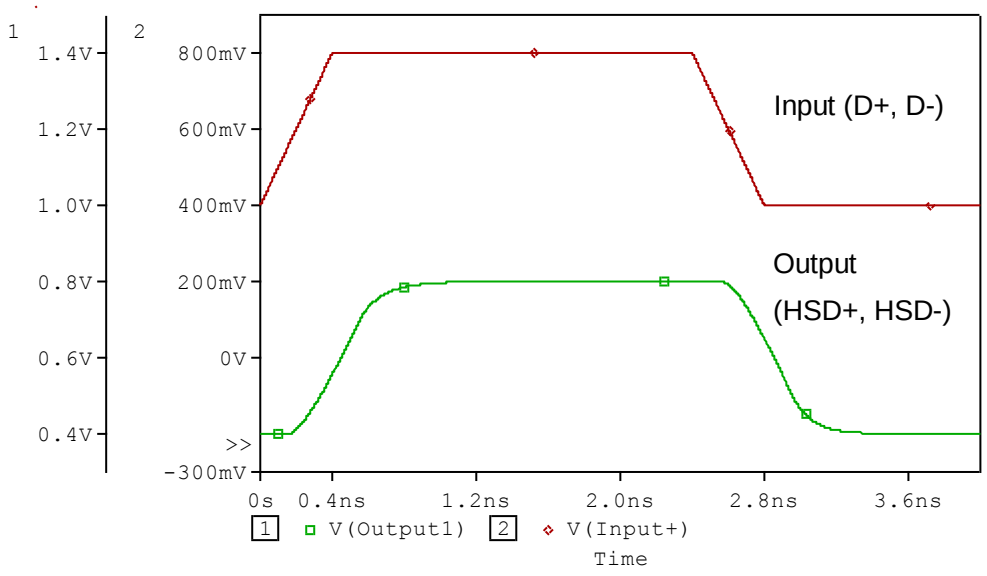
Simulation Result

Condition: V_{CC} = 3.6 V, V_{IN} = V_{CC} or GND, I_{OUT} = 0

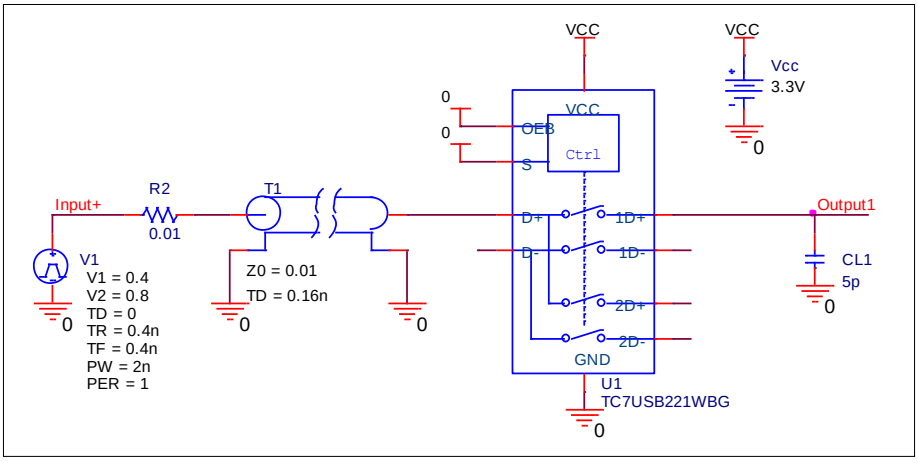
Parameters	Measurement	Simulation	%Error
I_{CC} (uA)	**2.0**	**1.998**	**-0.10**

Propagation Delay Time Characteristics

Simulation result



Evaluation circuit

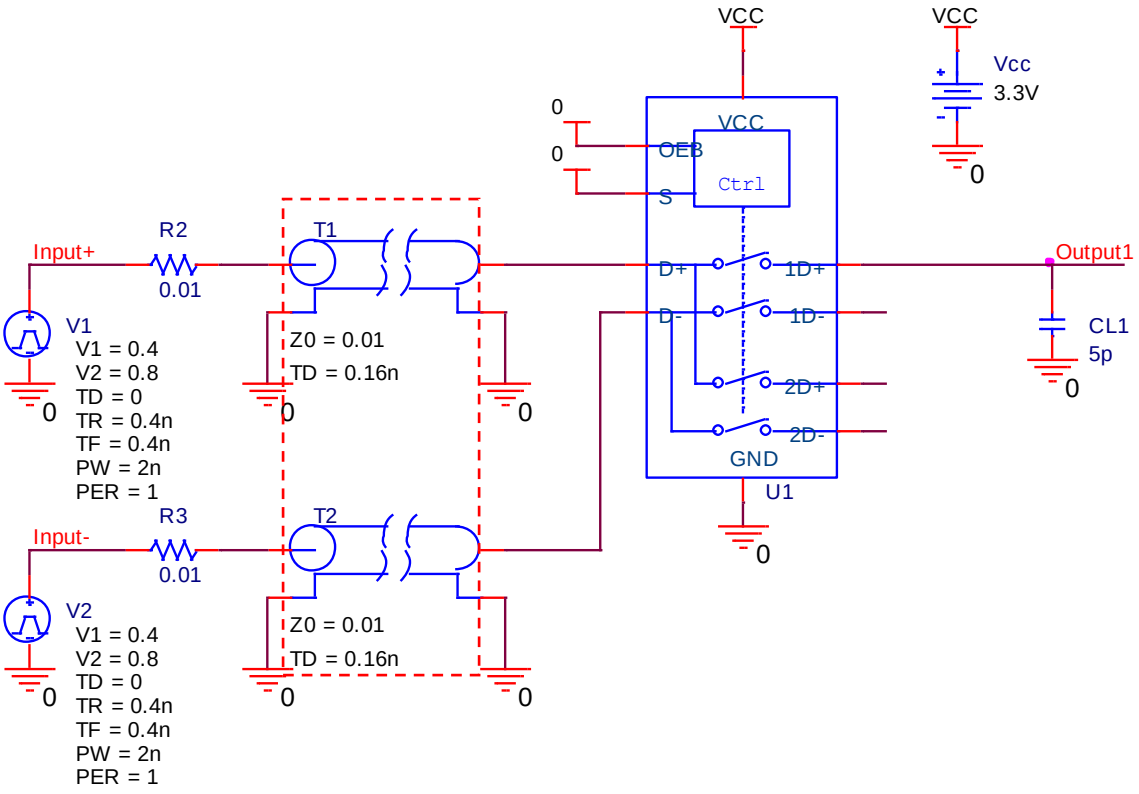


Simulation Result

Condition: V_{CC} = 3.3 V, C_L = 5pF, S = H or L

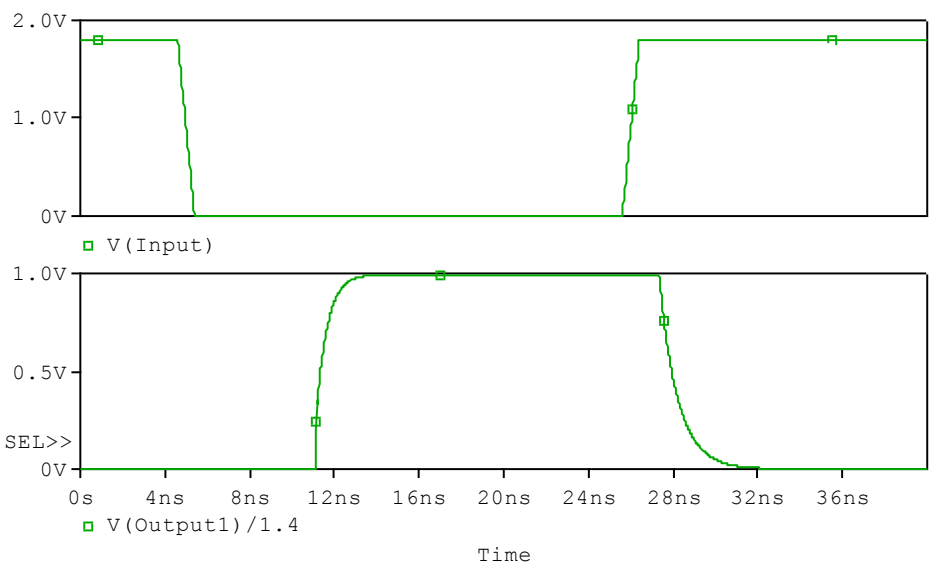
Parameters	Measurement	Simulation	%Error
tpd (ns) (Note 1)	**0.25**	**0.251**	**0.40**
$t_{SK(P)}$ (ns)	**0.1 [Typ.]**	**0.005**	**-**
$t_{SK(O)}$ (ns)	**0.1 [Typ.]**	**0**	**-**

Note 1: Propagation Delay Time Characteristics of TC7USB31FK are model using transmission line model with **TD=0.16n** and Z0 that is matched with Z_{OUT} of the input signal.

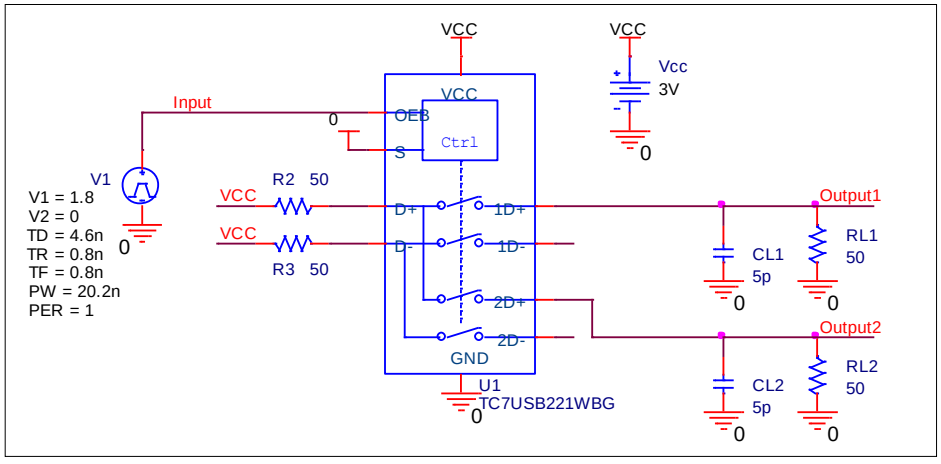


Turn ON/Turn OFF Time ($\overline{OE}$ to Output) Characteristics

Simulation result



Evaluation circuit



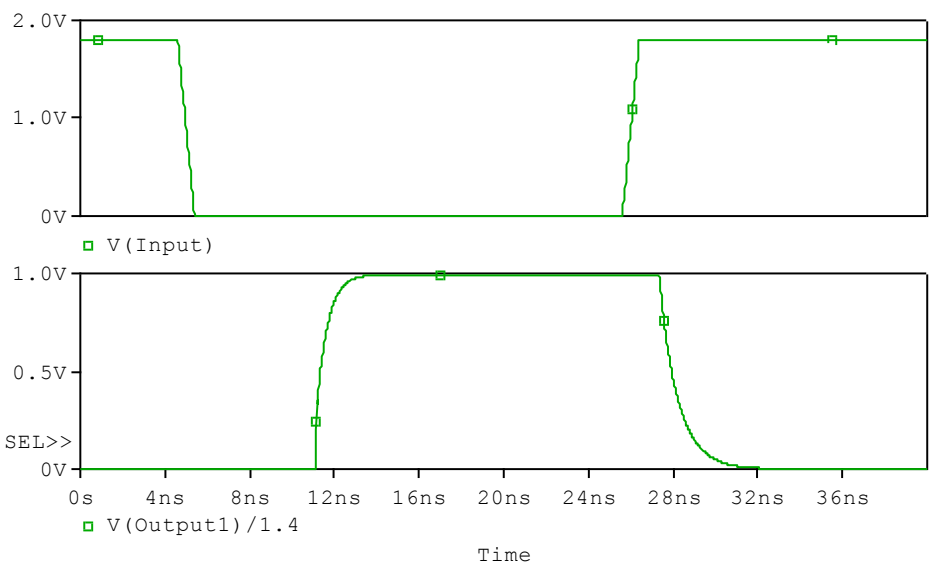
Simulation Result

Condition: V_{CC} = 3 V, R_L = 5Ω, C_L = 5pF, S = L

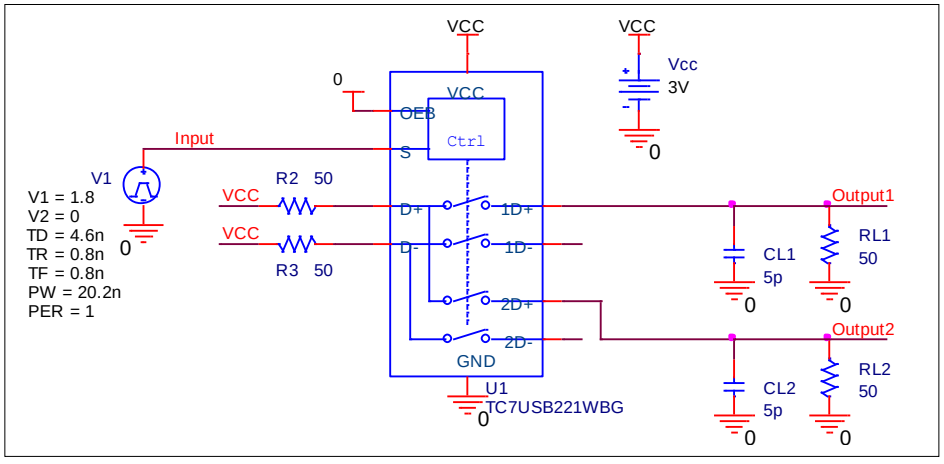
Parameters	Measurement	Simulation	%Error
t_{ON} (ns)	7.5	7.185	-4.20
t_{OFF} (ns)	3.3	3.354	1.64

Turn ON/Turn OFF Time (S to Output) Characteristics

Simulation result



Evaluation circuit



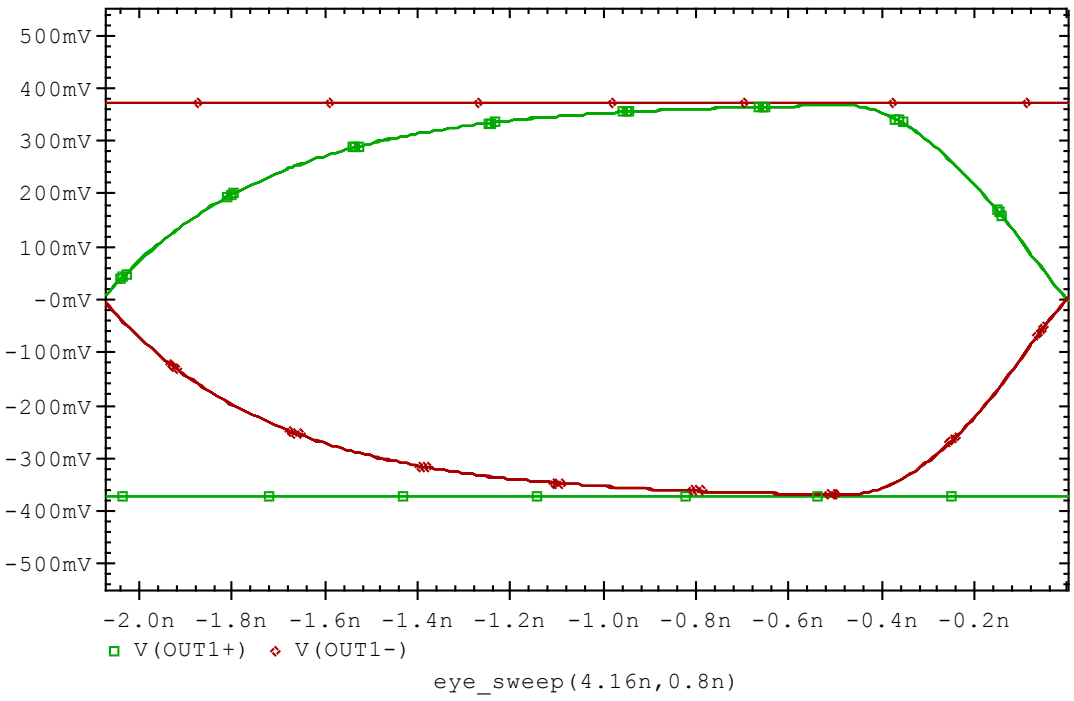
Simulation Result

Condition: V_{CC} = 3 V, R_L = 5Ω, C_L = 5pF

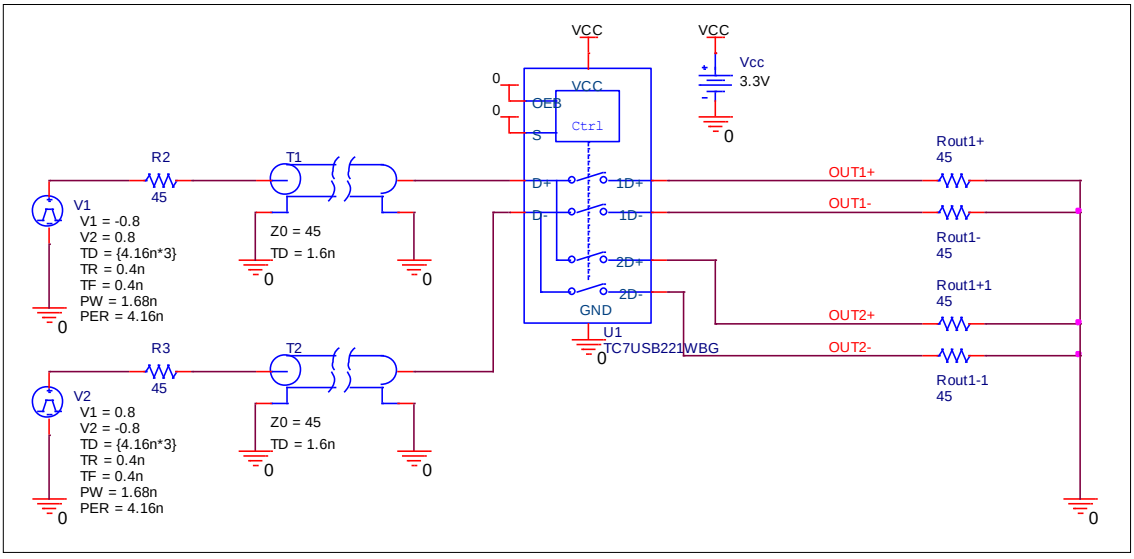
Parameters	Measurement	Simulation	%Error
t_{ON} (ns)	7.5	7.192	-4.11
t_{OFF} (ns)	3.3	3.365	1.97

USB2.0 Eye Pattern Characteristics

Simulation result

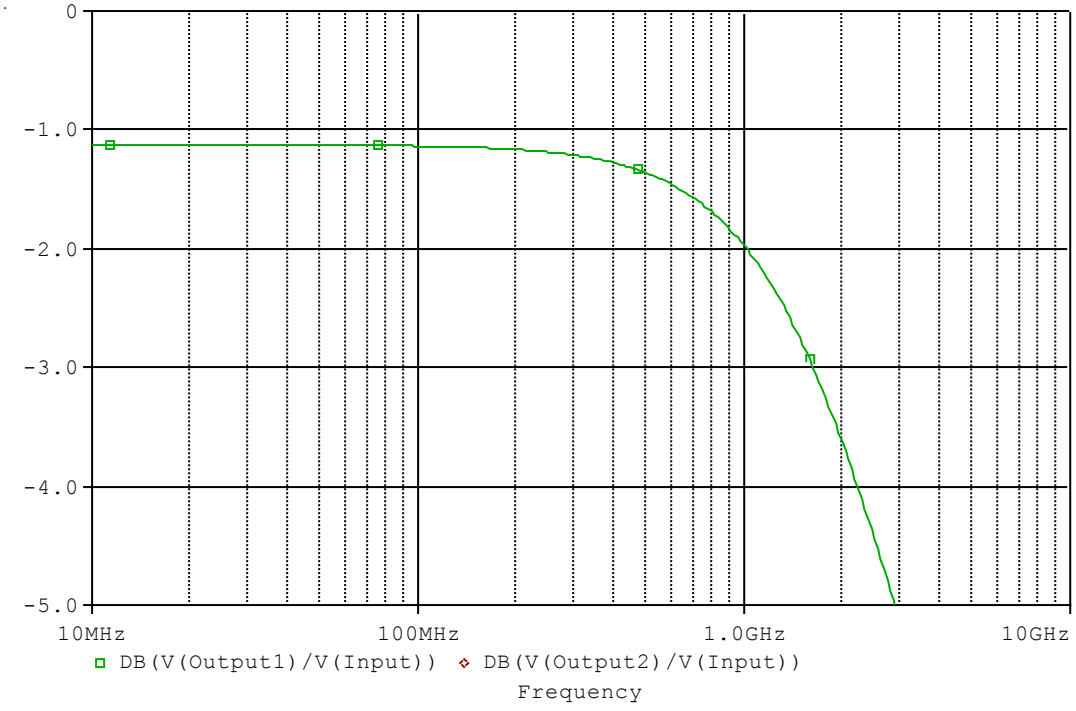


Evaluation circuit



Frequency Characteristics

Simulation result



Evaluation circuit