

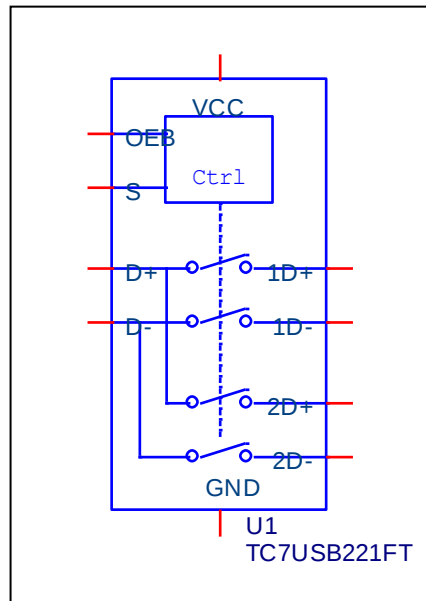
Device Modeling Report

COMPONENTS: USB Switch
PART NUMBER: TC7USB221FT
MANUFACTURER: TOSHIBA



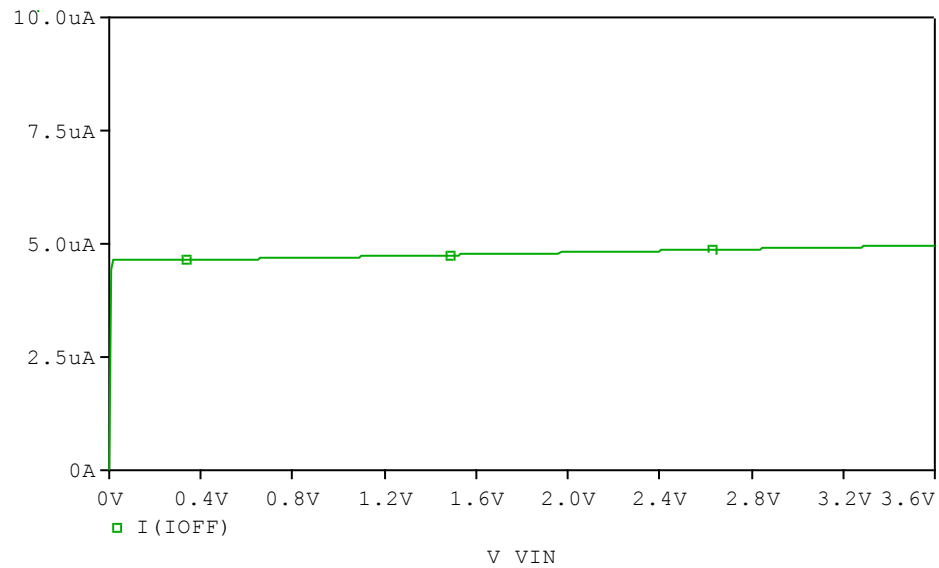
Bee Technologies Inc.

Circuit Configuration

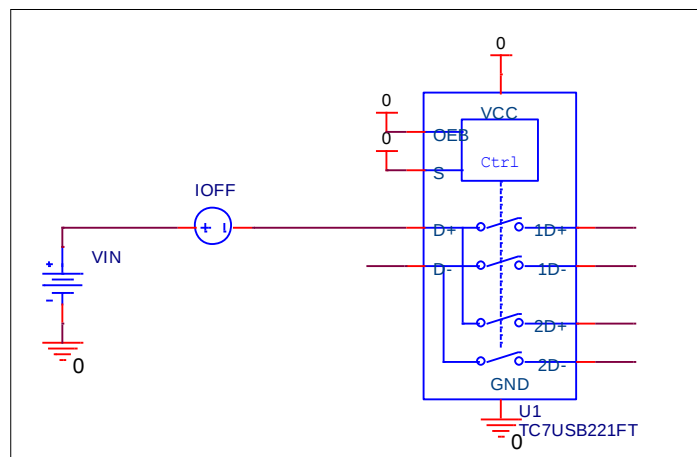


Power-Off Leakage Current Characteristics

Simulation result



Evaluation circuit



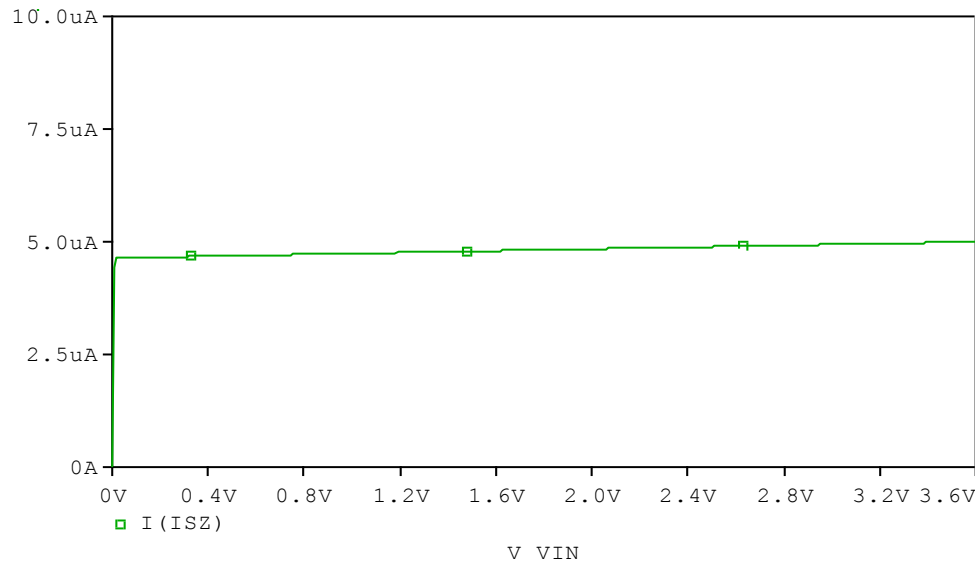
Simulation Result

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

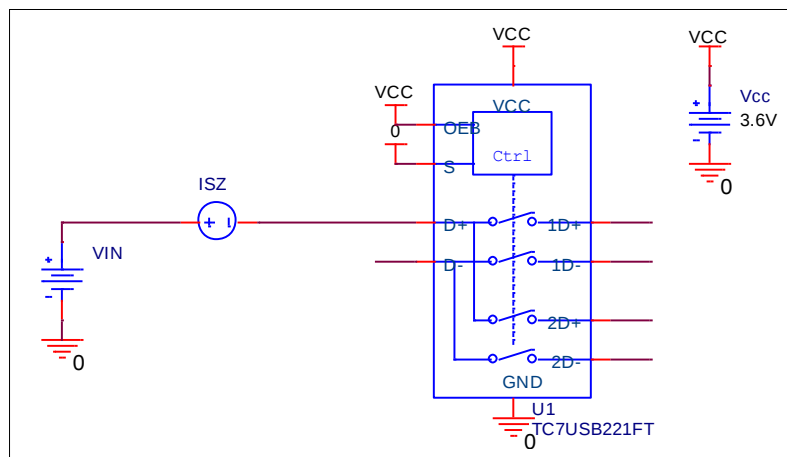
Parameters	Measurement	Simulation	%Error
I_{OFF} (μA)	5.0	4.966	-0.68

Off-State Leakage Current Characteristics

Simulation result



Evaluation circuit



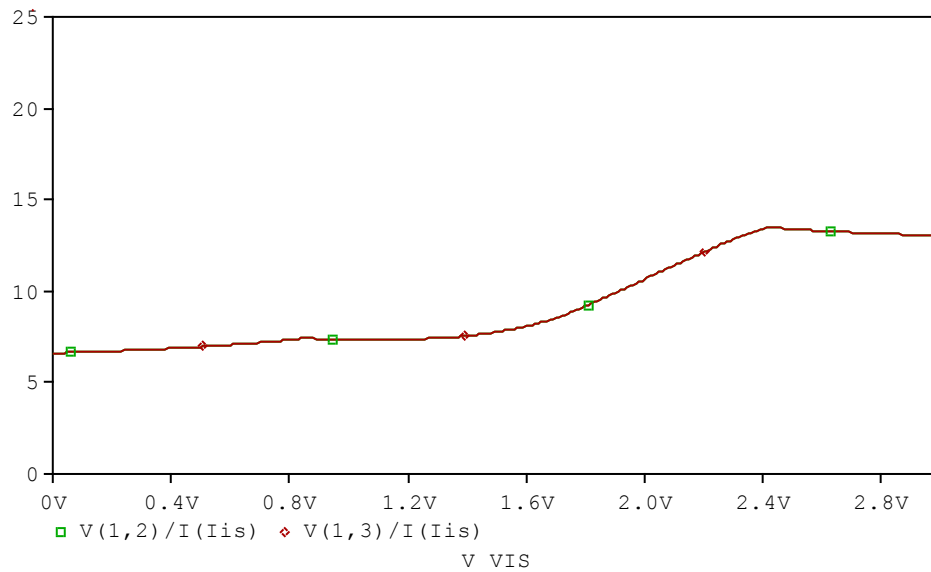
Simulation Result

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

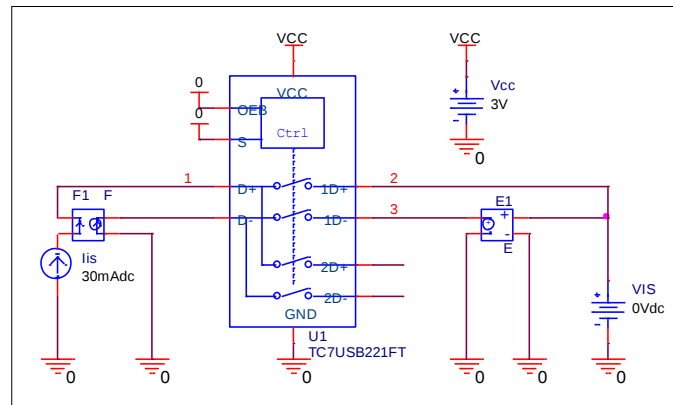
Parameters	Measurement	Simulation	%Error
I_{SZ} (μA)	5.0	5.0	0

ON Resistance Characteristics

Simulation result



Evaluation circuit



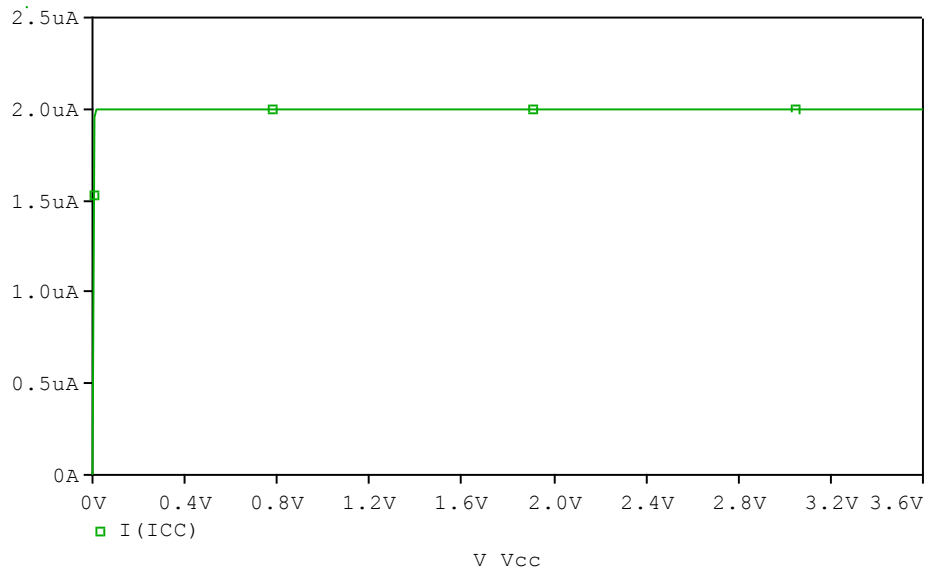
Simulation Result

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

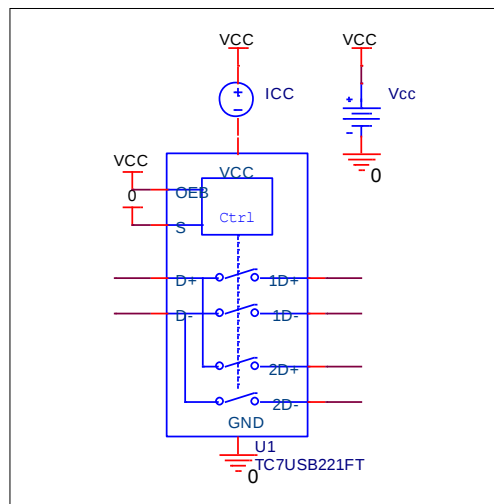
Parameters	Measurement	Simulation	%Error
$R_{ON} (\Omega) (V_{IS}=0V)$	6.5	6.612	1.72
$R_{ON} (\Omega) (V_{IS}=0.4V)$	7.0	6.867	-1.90
$R_{ON} (\Omega) (V_{IS}=3.0V)$	13	13.034	0.26
$R_{ON} (\Omega) (V_{IS}=0.4V, 1V)$	0.5	0.499	-0.20

Quiescent Supply Current Characteristics

Simulation result



Evaluation circuit



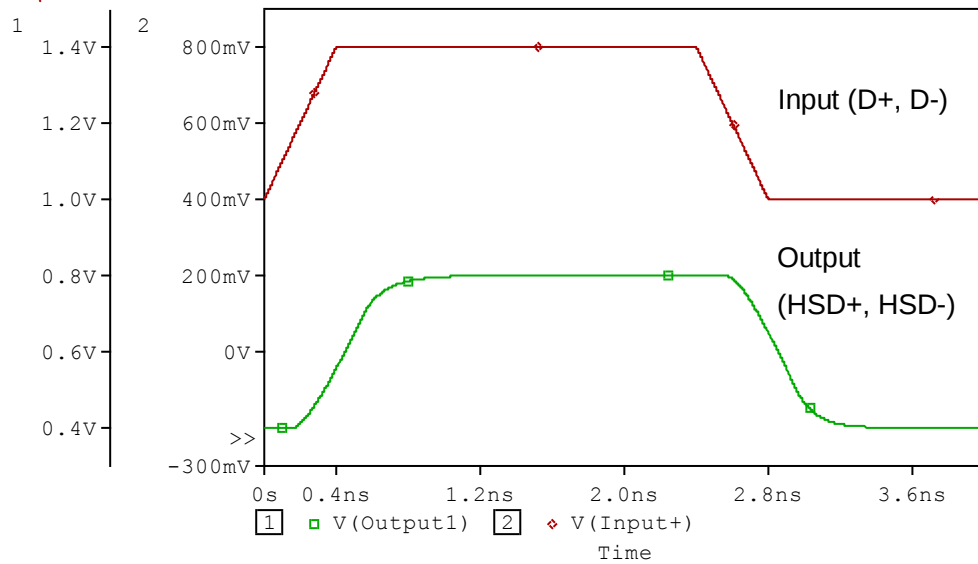
Simulation Result

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

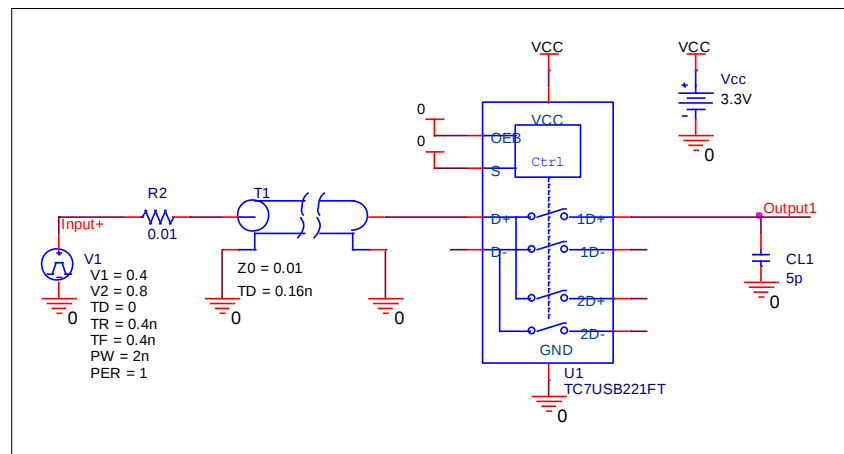
Parameters	Measurement	Simulation	%Error
$I_{CC} \text{ (uA)}$	2.0	1.998	-0.10

Propagation Delay Time Characteristics

Simulation result



Evaluation circuit

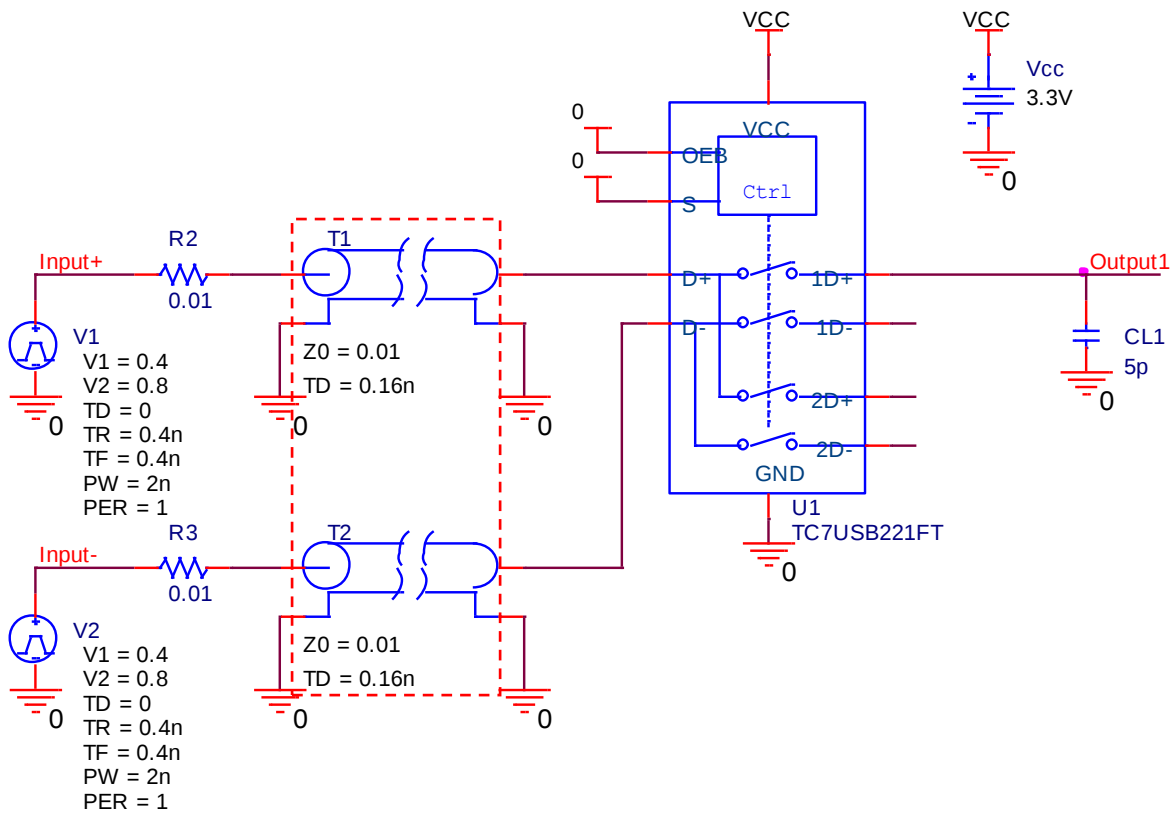


Simulation Result

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

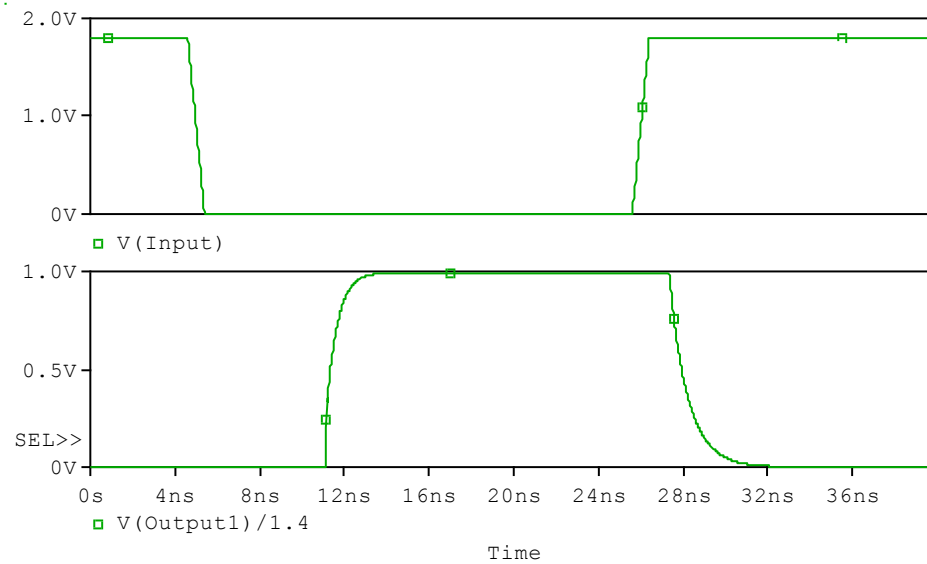
Parameters	Measurement	Simulation	%Error
tpd (ns) (Note 1)	0.25	0.251	0.40
t_{SK(P)} (ns)	0.1 [Typ.]	0.005	-
t_{SK(O)} (ns)	0.1 [Typ.]	0	-

Note 1: Propagation Delay Time Characteristics of TC7USB31FK are model using transmission line model with **TD=0.16n** and Z_0 that is matched with Z_{OUT} of the input signal.

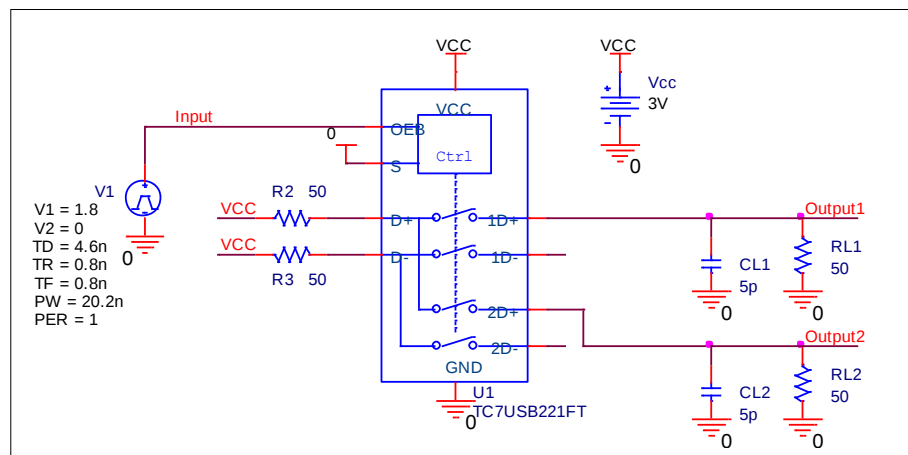


Turn ON/Turn OFF Time ($\overline{\text{OE}}$ to Output) Characteristics

Simulation result



Evaluation circuit



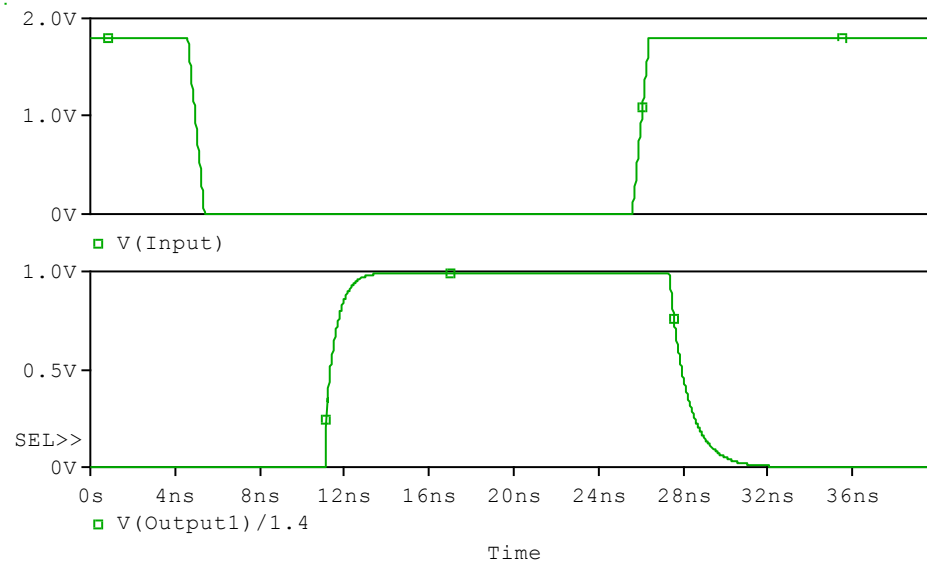
Simulation Result

Condition: $V_{CC} = 3\text{ V}$, $R_L = 50\Omega$, $C_L = 5\text{ pF}$, $S = L$

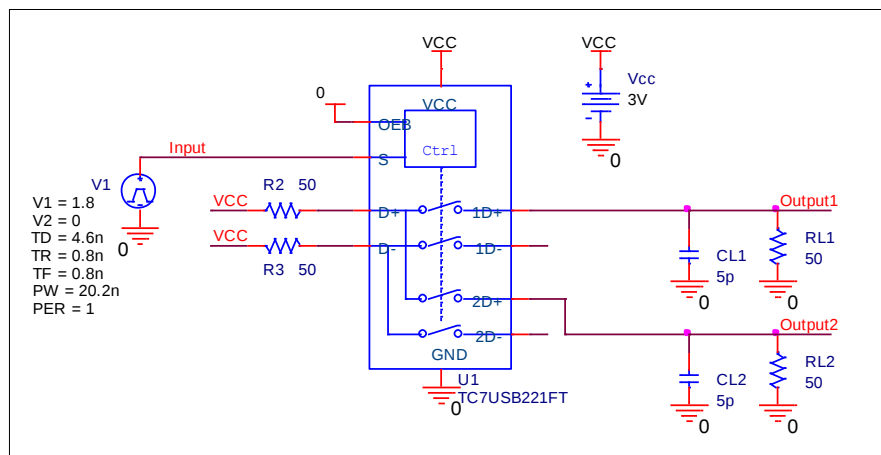
Parameters	Measurement	Simulation	%Error
$t_{\text{ON}} (\text{ns})$	7.5	7.185	-4.20
$t_{\text{OFF}} (\text{ns})$	3.3	3.354	1.64

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

Simulation result



Evaluation circuit



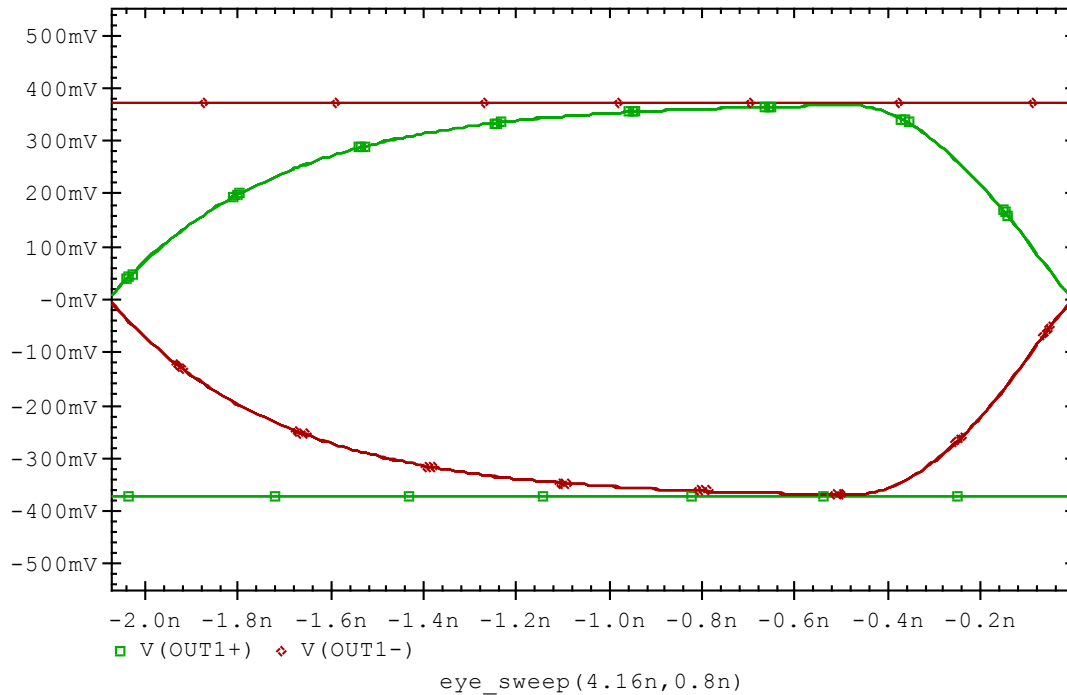
Simulation Result

Condition: $V_{CC} = 3\text{ V}$, $R_L = 5\Omega$, $C_L = 5\text{ pF}$

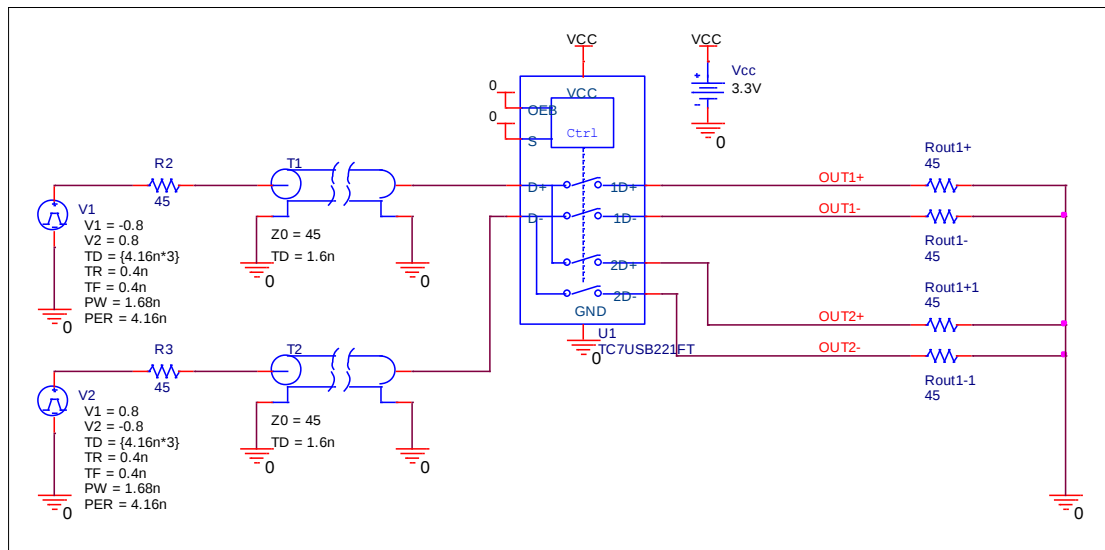
Parameters	Measurement	Simulation	%Error
$t_{ON} \text{ (ns)}$	7.5	7.192	-4.11
$t_{OFF} \text{ (ns)}$	3.3	3.365	1.97

USB2.0 Eye Pattern Characteristics

Simulation result

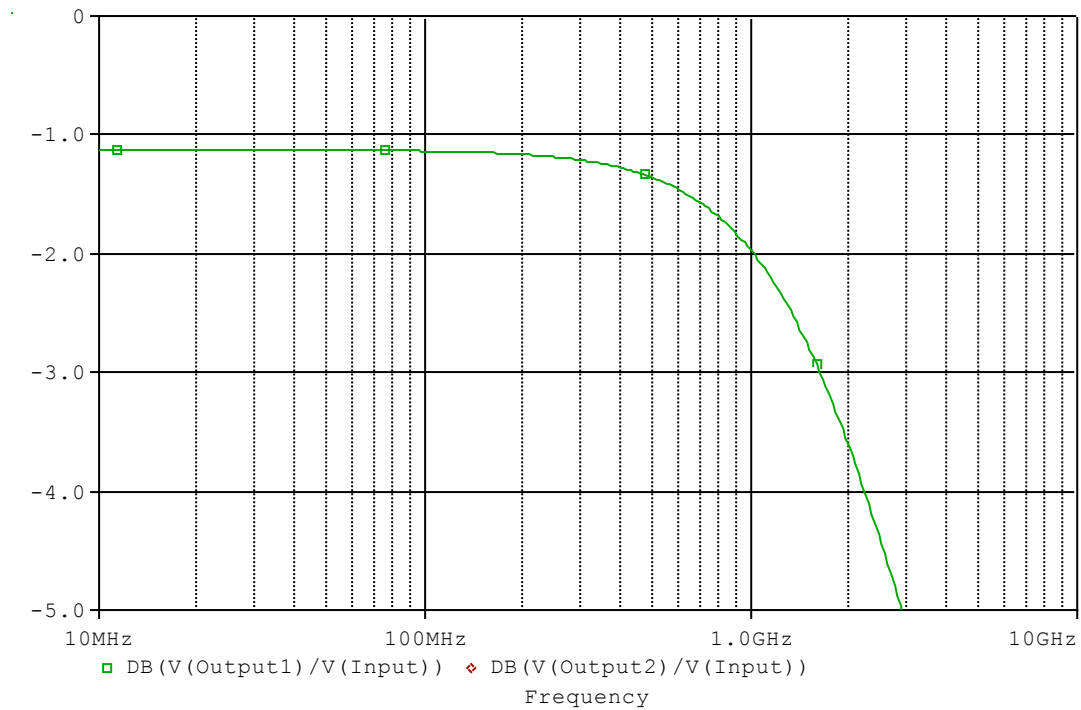


Evaluation circuit



Frequency Characteristics

Simulation result



Evaluation circuit

