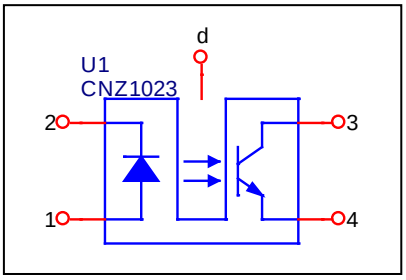
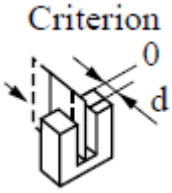
Device Modeling Report

COMPONENTS: PHOTO INTERRUPTER
PART NUMBER: CNZ1023
MANUFACTURER: PANASONIC

Bee Technologies Inc.

SPICE MODEL

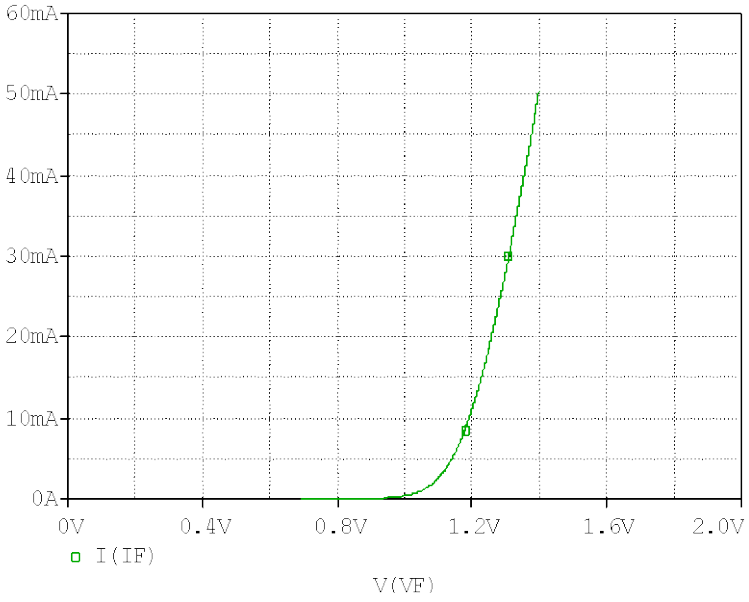




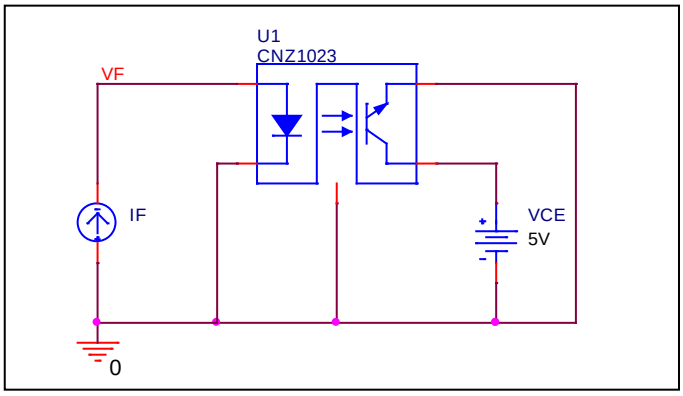
Input the distance d (see picture above) to the model by connecting a voltage source to pin d, 1V input to pin d equals to 1mm. distance.

LED IV Curve Characteristics

Circuit Simulation result

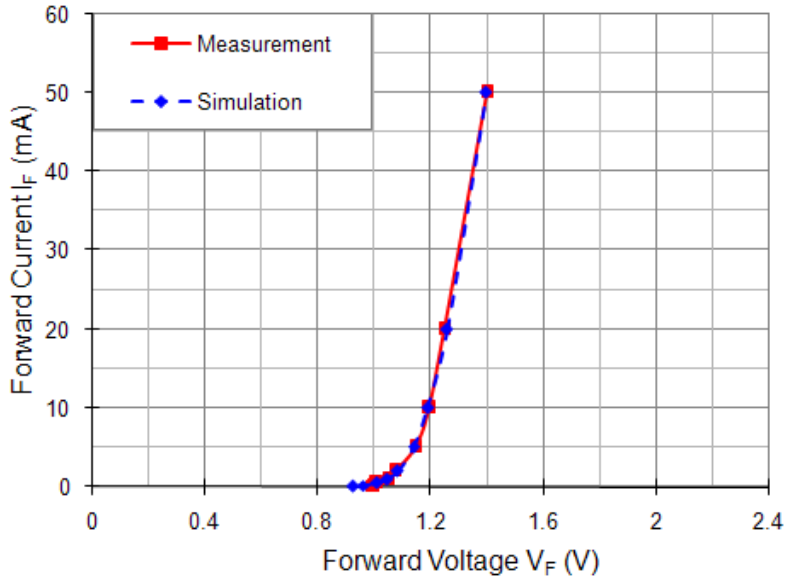


Evaluation circuit



Comparison graph

Circuit Simulation result

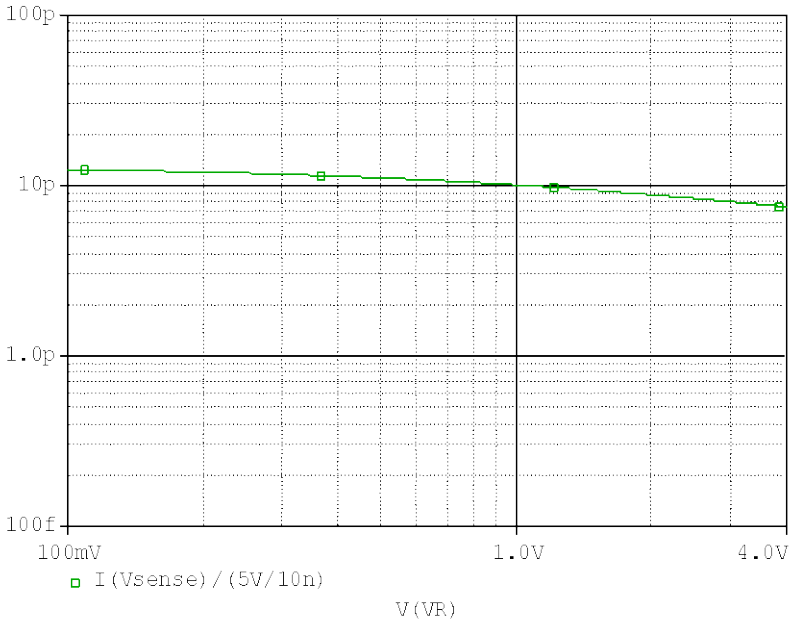


Simulation Result

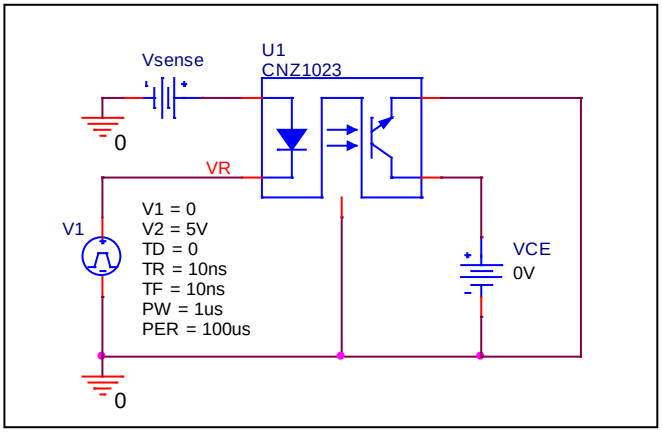
I_F (mA)	V_F (V)		%Error
	Measurement	Simulation	
0.1	0.975	0.927	-4.92
0.2	0.999	0.962	-3.70
0.5	1.010	1.009	-0.10
1.0	1.050	1.047	-0.29
2.0	1.075	1.085	0.93
5.0	1.147	1.141	-0.52
10.0	1.197	1.191	-0.50
20.0	1.250	1.258	0.64
50.0	1.400	1.398	-0.14

Capacitance Characteristics

Circuit Simulation Result

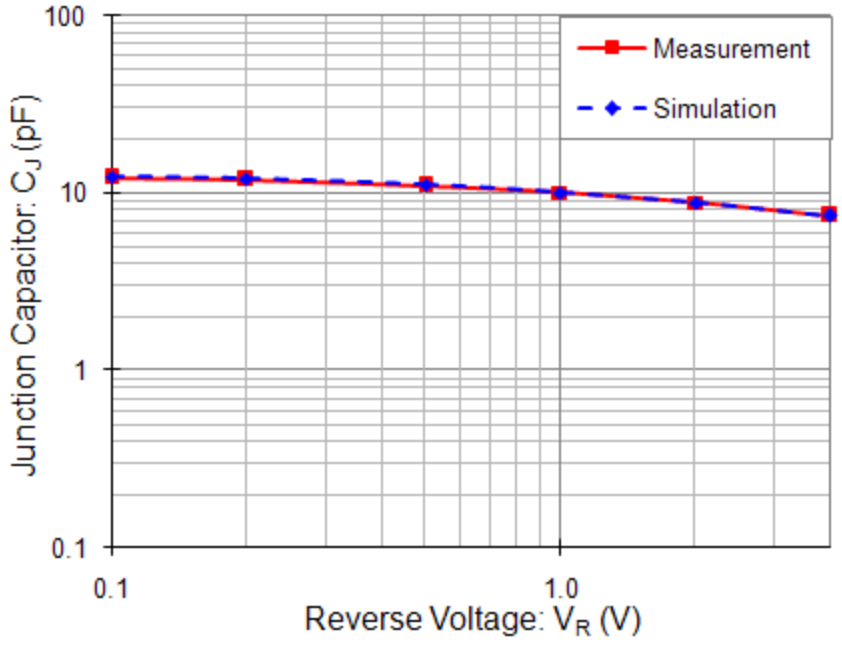


Evaluation Circuit



Comparison Graph

Circuit Simulation result

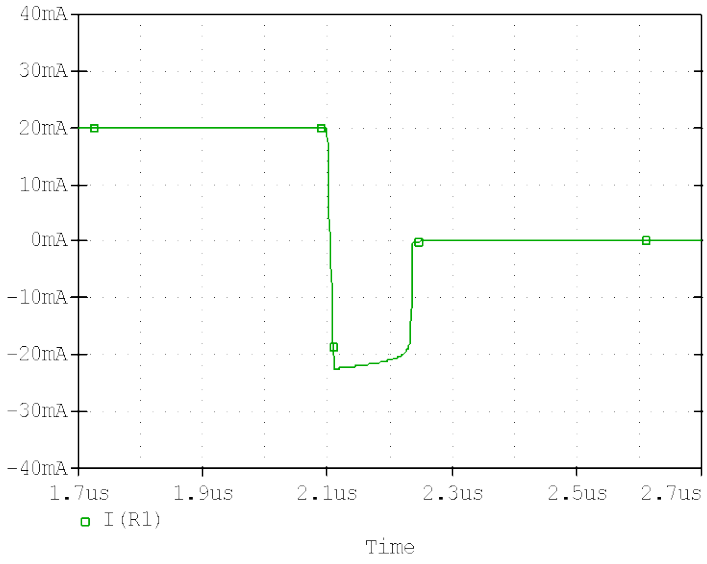


Comparison table

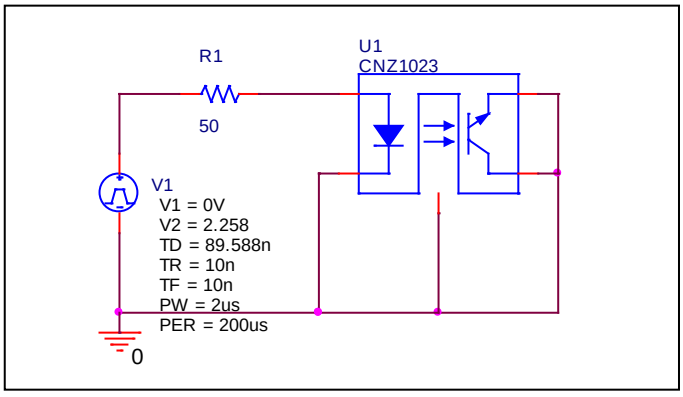
V_R (V)	C_J (pF)		%Error
	Measurement	Simulation	
0.1	12.275	12.358	0.68
0.2	11.937	12.060	1.03
0.5	11.042	11.139	0.88
1	10.047	10.094	0.47
2	8.806	8.817	0.12
4	7.456	7.471	0.19

Reverse Recovery Characteristics

Circuit Simulation result



Evaluation circuit

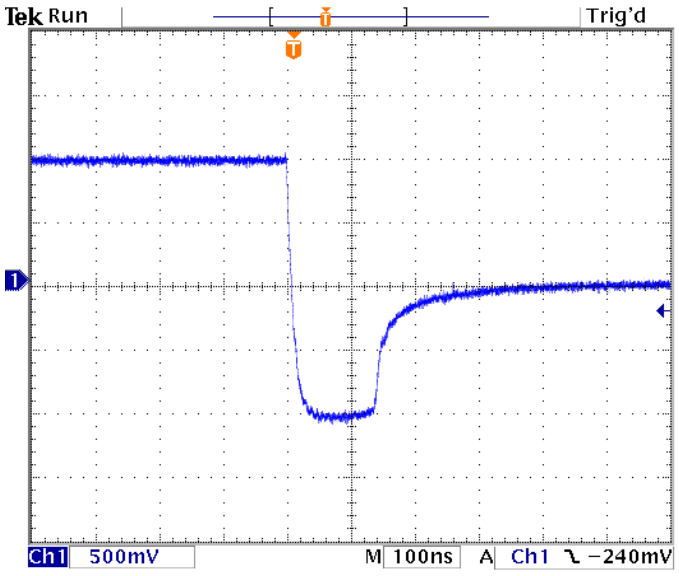


Compare Measurement vs. Simulation

I_F=20mA

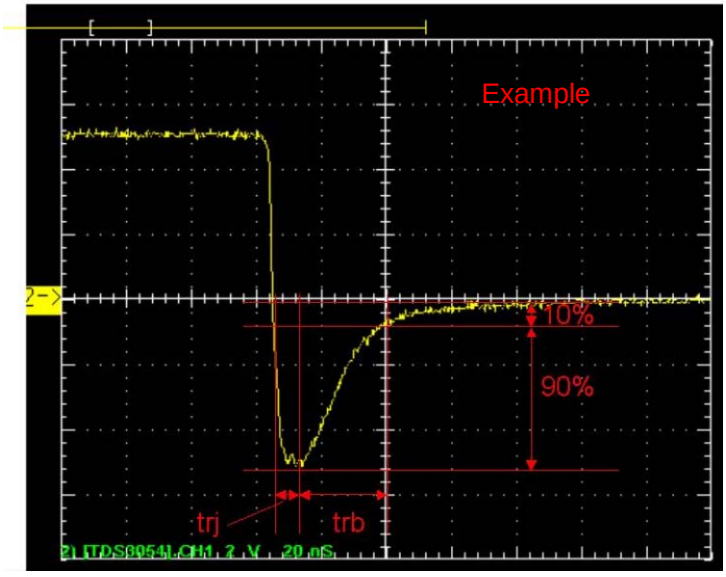
Parameter	Unit	Measurement	Simulation	%Error
trj	**ns**	**124.000**	**123.385**	**-0.50**

Reverse Recovery Characteristics Reference



Trj=124(ns)

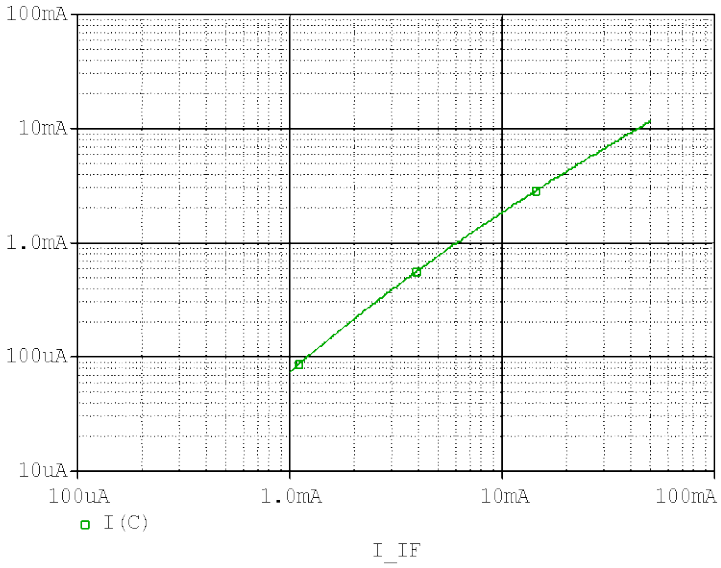
Conditions: Ifwd=20mA, Rl=50



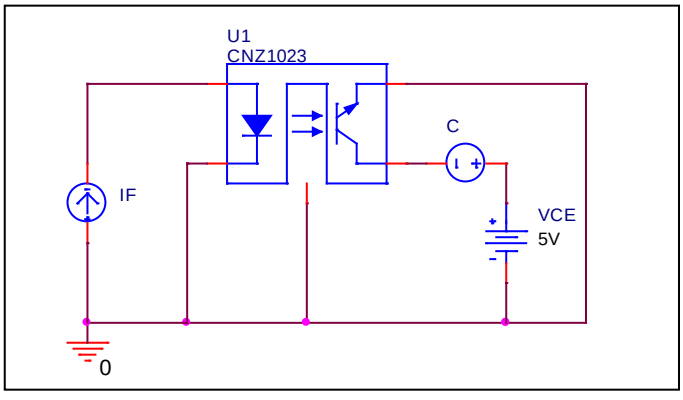
Relation between trj and trb

CTR (Current Transfer Ratio) Characteristics (V_{CE}=5V)

Circuit Simulation result

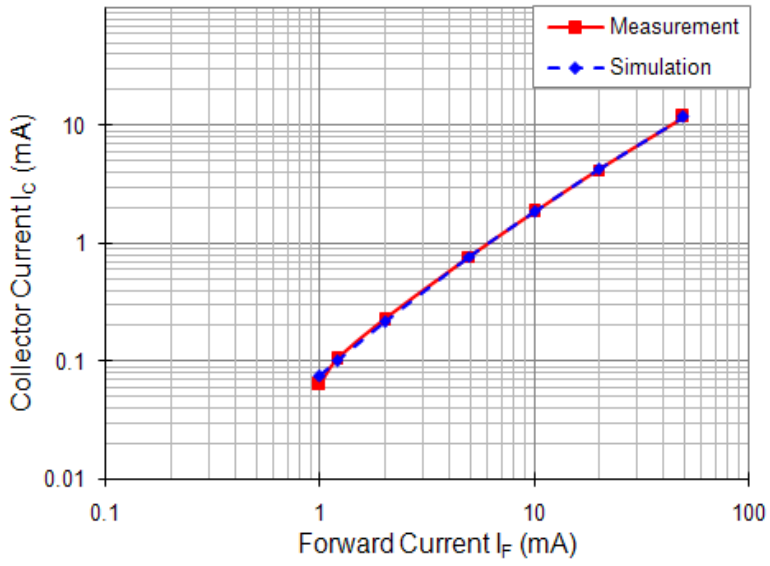


Evaluation circuit



Comparison graph

Circuit Simulation result

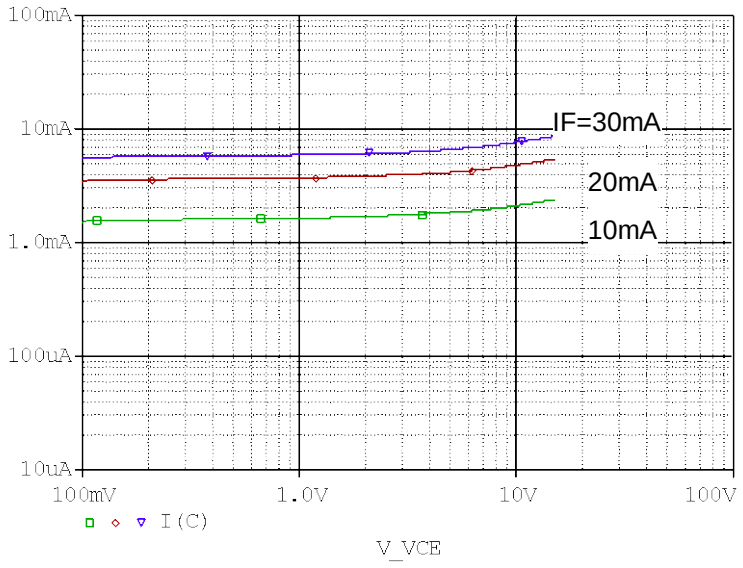


Simulation Result

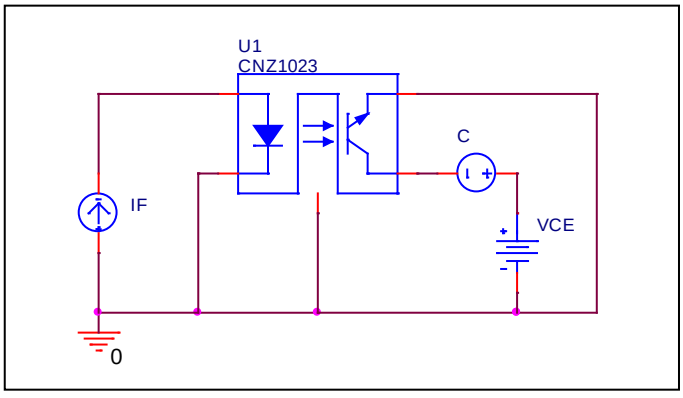
I_F (mA)	I_C (mA)		%Error
	Measurement	Simulation	
1.2	0.104	0.099	-4.42
2.0	0.224	0.215	-4.02
5.0	0.765	0.769	0.52
10.0	1.840	1.846	0.33
20.0	4.160	4.186	0.62
50.0	11.700	11.662	-0.32

Output Voltage Characteristics

Circuit Simulation result

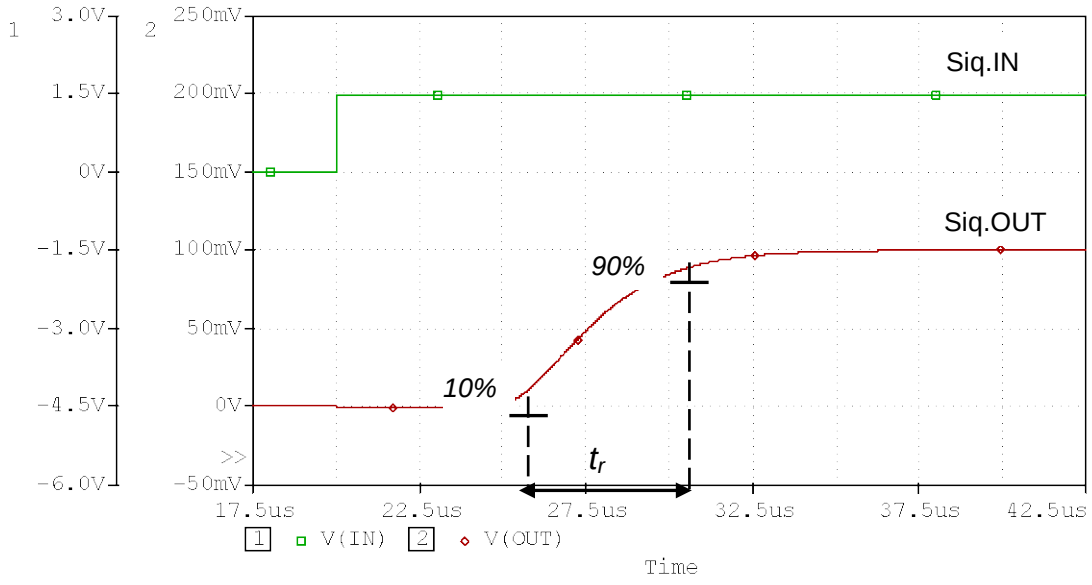


Evaluation circuit

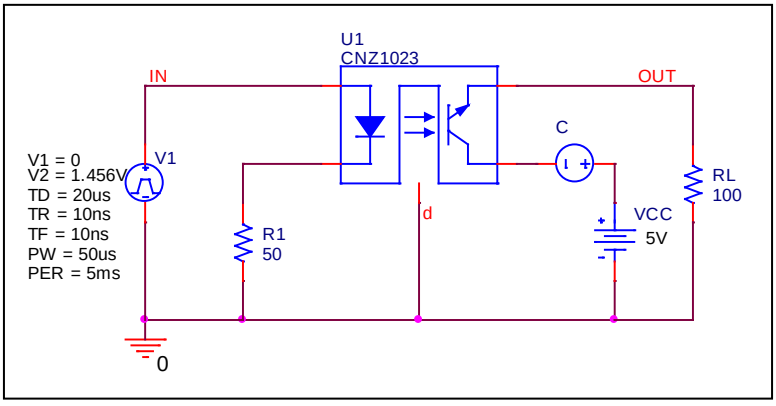


Turn-on Time Characteristics (R_L=100Ω)

Circuit Simulation result



Evaluation circuit



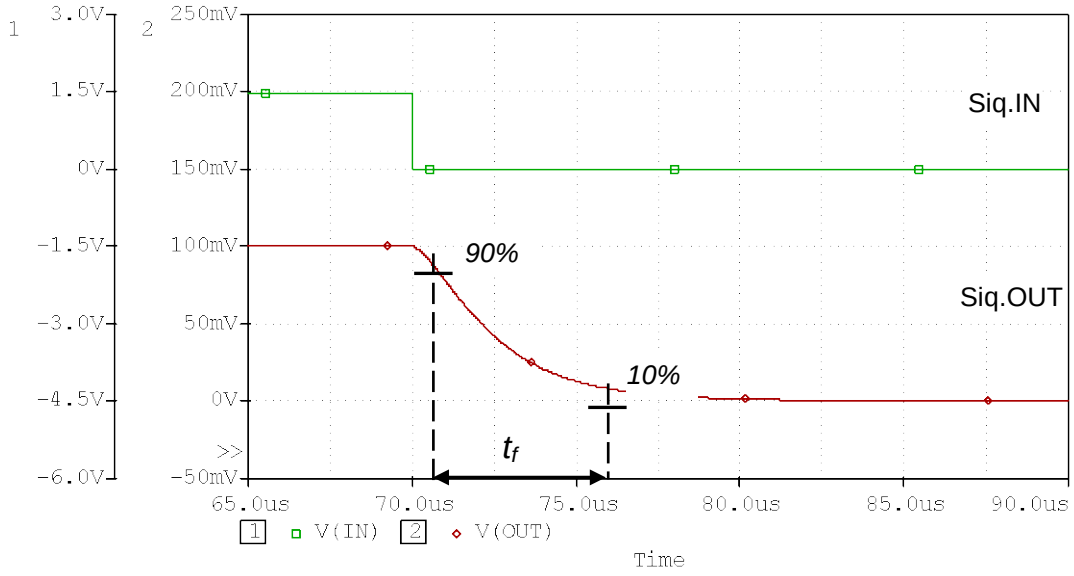
Simulation Result

V_{CC}=5V, I_F=1mA, R_L=100Ω

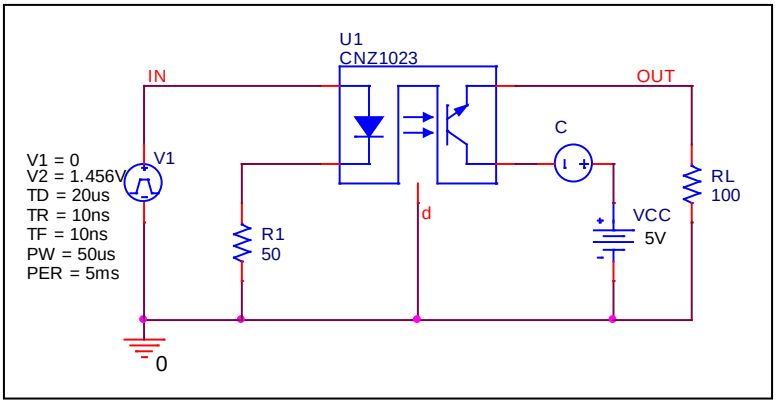
Parameter	Unit	Measurement	Simulation	%Error
t_r	us	5.000	4.983	-0.34

Turn-off Time Characteristics (R_L=100Ω)

Circuit Simulation result



Evaluation circuit



Simulation Result

V_{CC}=5V, I_F=1mA, R_L=100Ω

Parameter	Unit	Measurement	Simulation	%Error
t_f	us	5.000	5.031	0.62