

Device Modeling Report

COMPONENTS: PHOTOCOUPLER
PART NUMBER: PS2501L-4
MANUFACTURER: NEC



Bee Technologies Inc.

DIODE MODEL

Pspice model Parameter	Model description
IS	Saturation Current
N	Emission Coefficient
RS	Series Resistance
IKF	High-injection Knee Current
CJO	Zero-bias Junction Capacitance
M	Junction Grading Coefficient
VJ	Junction Potential
ISR	Recombination Current Saturation Value
BV	Reverse Breakdown Voltage(a positive value)
IBV	Reverse Breakdown Current(a positive value)
TT	Transit Time

BIPOLAR JUNCTION TRANSISTOR MODEL

Pspice model parameter	Model description
NR	Reverse Emission Coefficient
RB	Base Resistance
RC	Series Collector Resistance
CJE	Zero-bias Emitter-Base Junction Capacitance
CJC	Zero-bias Collector-Base Junction Capacitance
TF	Forward Transit Time
TR	Reverse Transit Time

VOLTAGE CONTROLLED VOLTAGE SOURCE MODEL(VCVS)

E<Name><(+)Node><(-)Node>VALUE={Expression}

E<Name><(+)Node><(-)Node>TABLE={Expression}

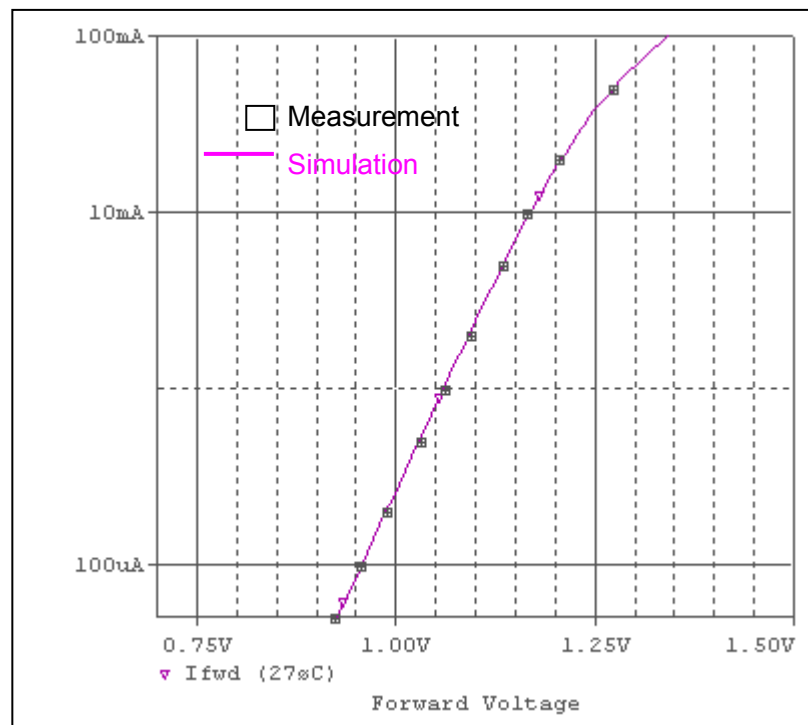
VOLTAGE CONTROLLED CURRENT SOURCE MODEL(VCCS)

E<Name><(+)Node><(–)Node>VALUE={Expression}

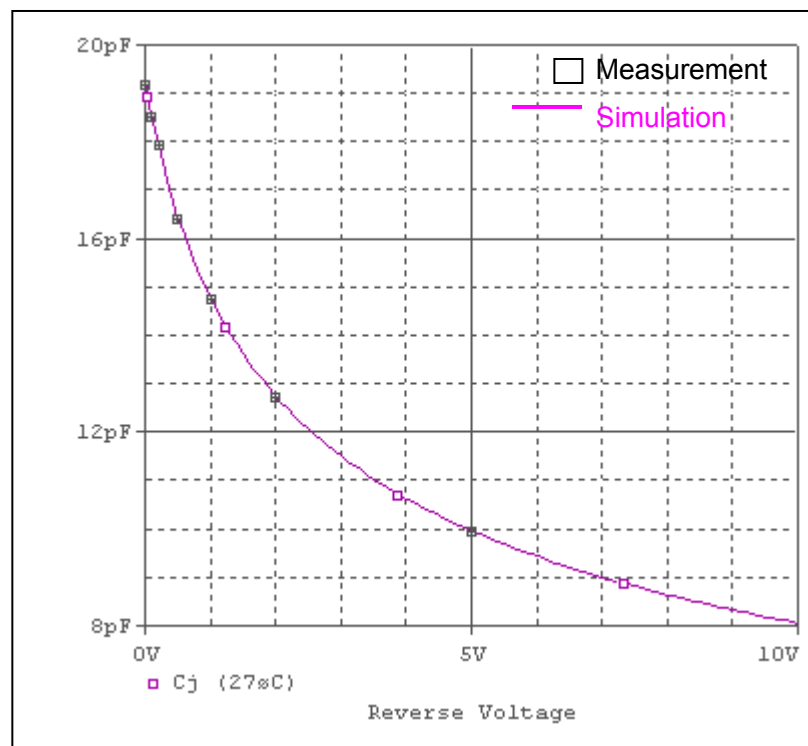
CURRENT CONTROLLED MODEL(W)

Pspice model parameter	Model description
IOFF	Controlling current to Off state
ION	Controlling current to On state
ROFF	Off Resistance
RON	On Resistance

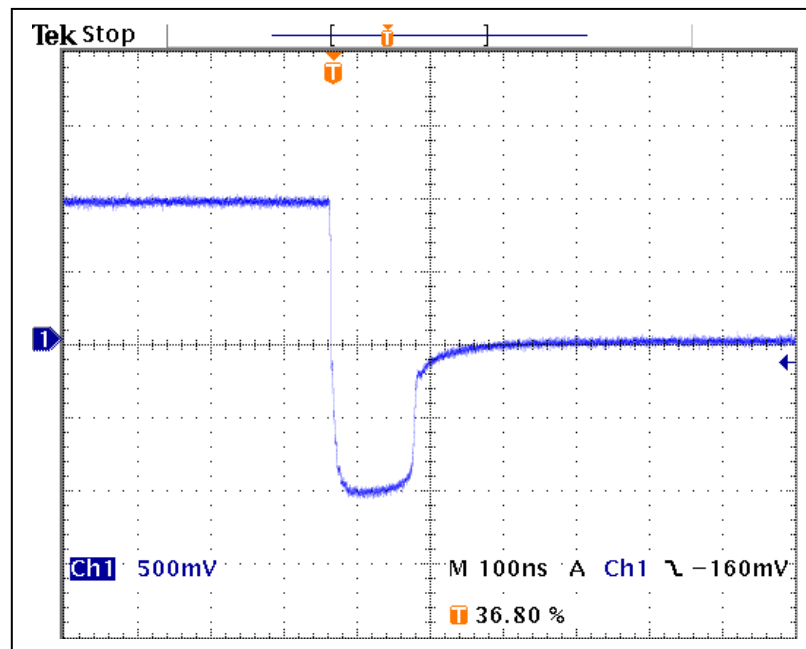
Input Device Forward Current Characteristics



Input Device Junction Capacitance Characteristics



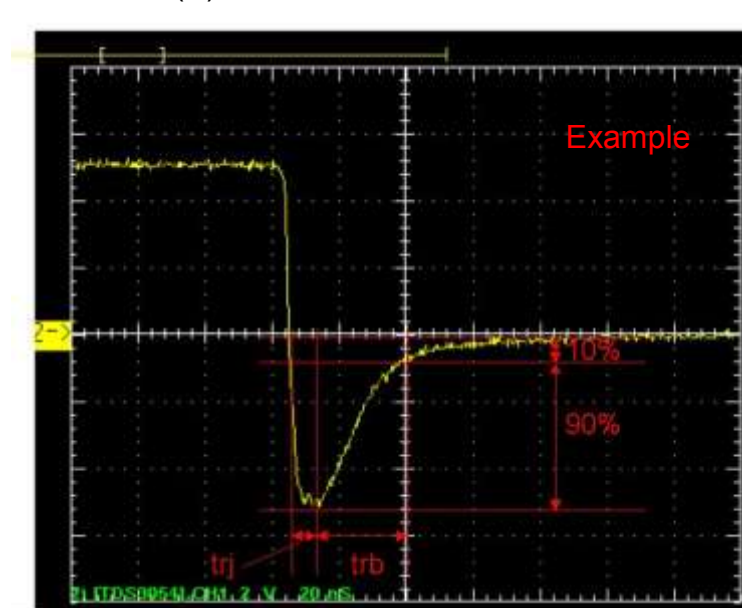
Input Device Reverse Recovery Characteristics



$t_{rj}=102\text{n(s)}$

$t_{rb}=32\text{n(s)}$

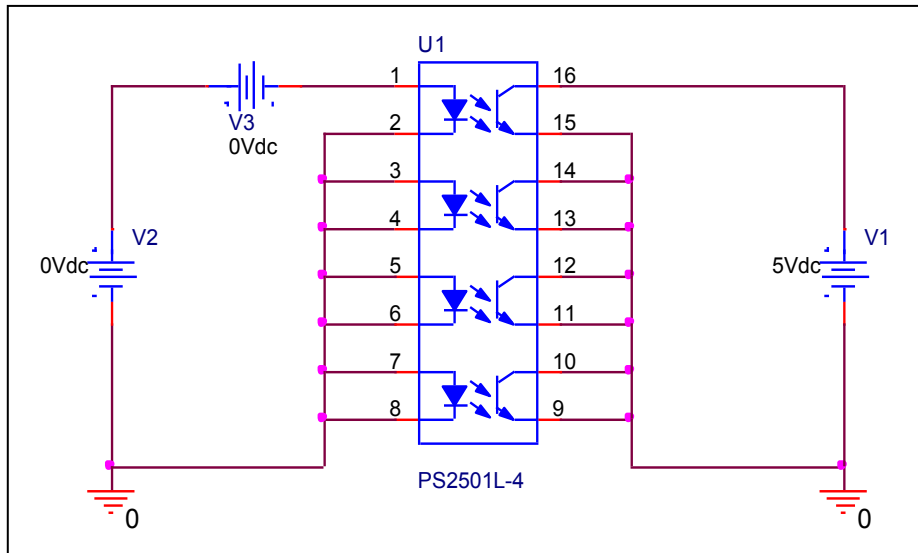
Conditions: $I_{fwd}=I_{rev}=0.04\text{(A)}$, $R_I=50$



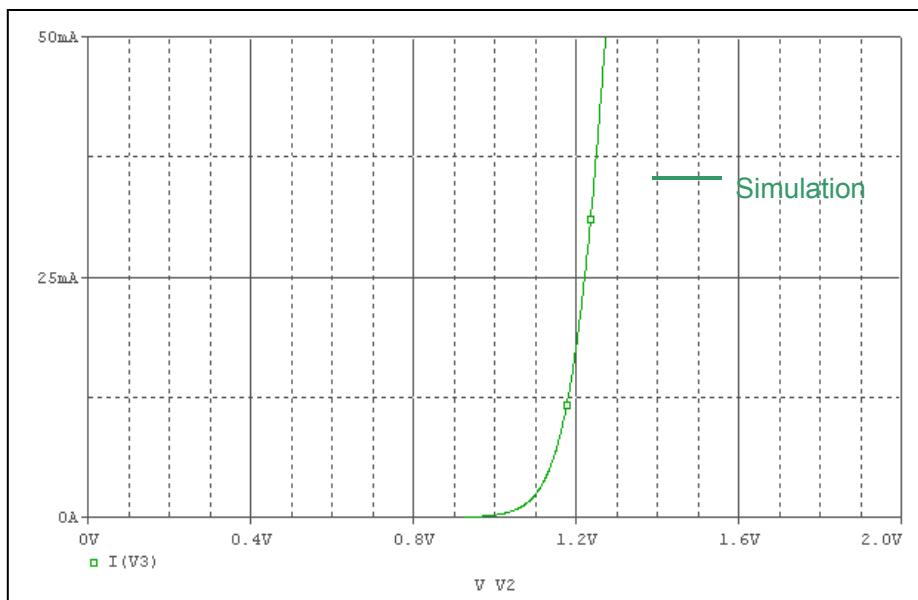
Relation between t_{rj} and t_{rb}

LED IV Curve Characteristics

Evaluation Circuit



Simulation result

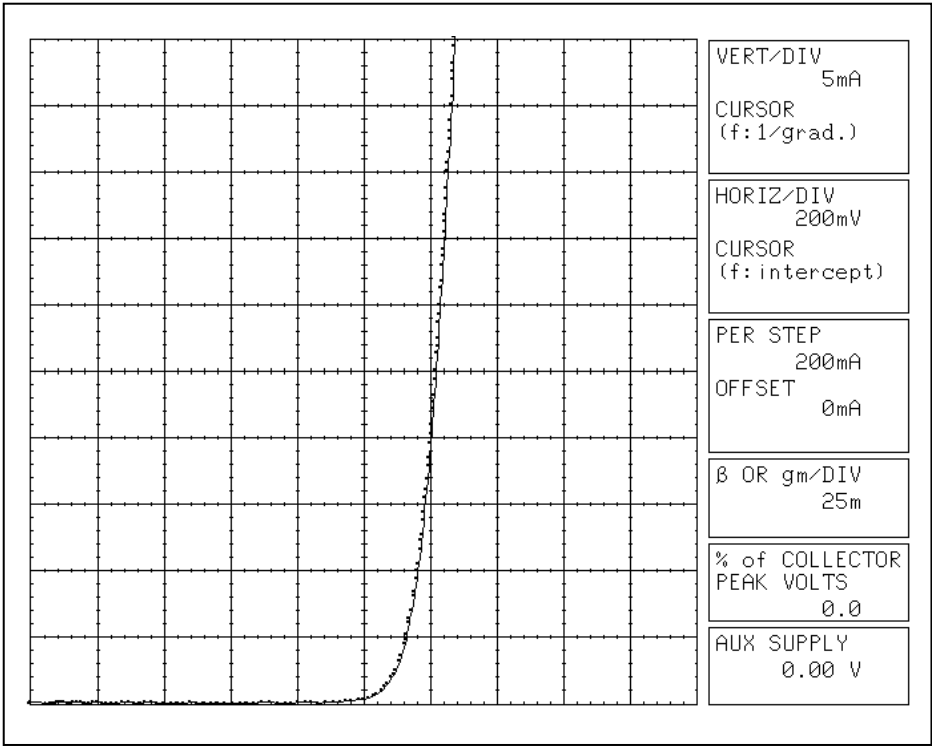


Comparison Table

Ifwd(mA)	Vfwd(V)		% Error
	Measurement	Simulation	
0.05	0.924	0.927	0.325
0.10	0.956	0.958	0.209
0.20	0.990	0.988	-0.202
0.50	1.032	1.029	-0.291
1.00	1.062	1.060	-0.188
2.00	1.094	1.092	-0.183
5.00	1.134	1.135	0.088
10.00	1.166	1.169	0.257
20.00	1.206	1.208	0.166
50.00	1.274	1.273	-0.078

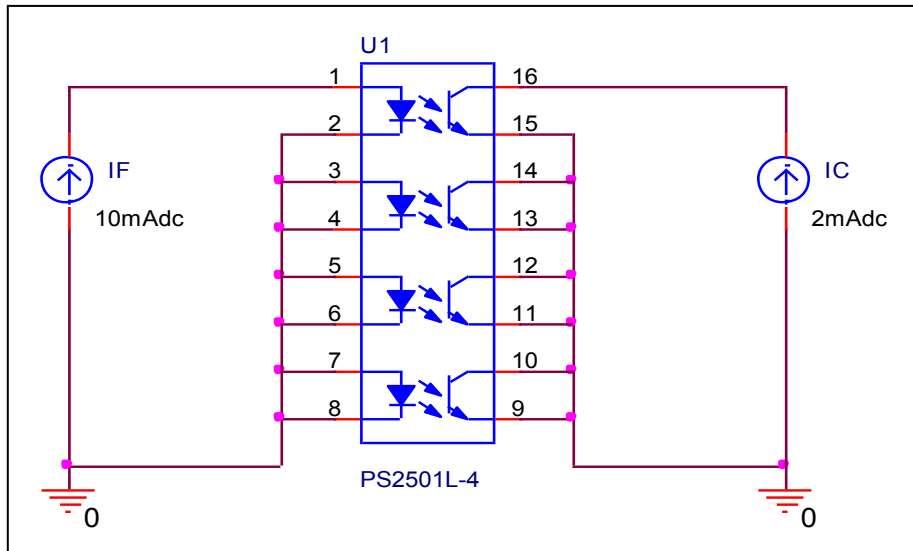
LED IV Curve Characteristics

Reference

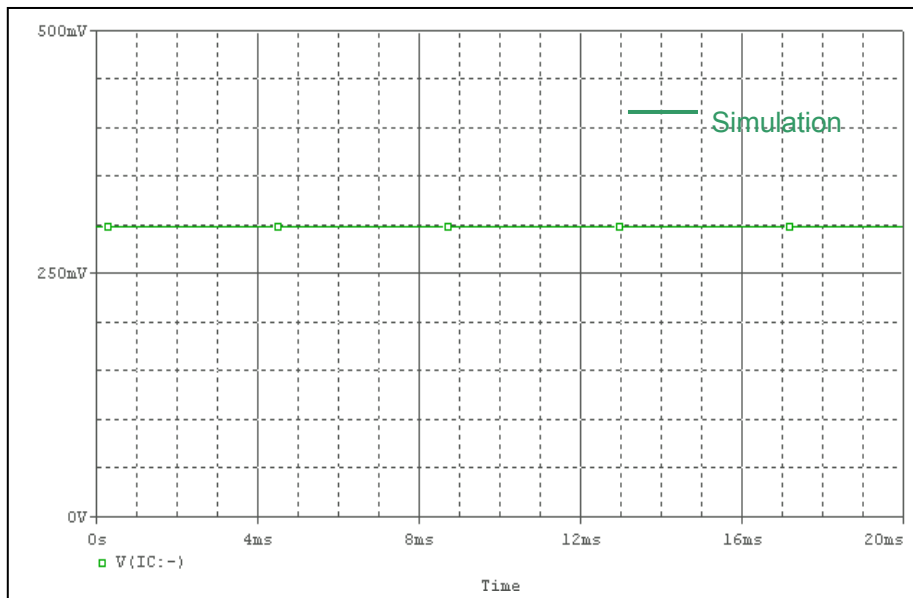


Transistor Saturation Characteristics

Evaluation Circuit



Simulation result

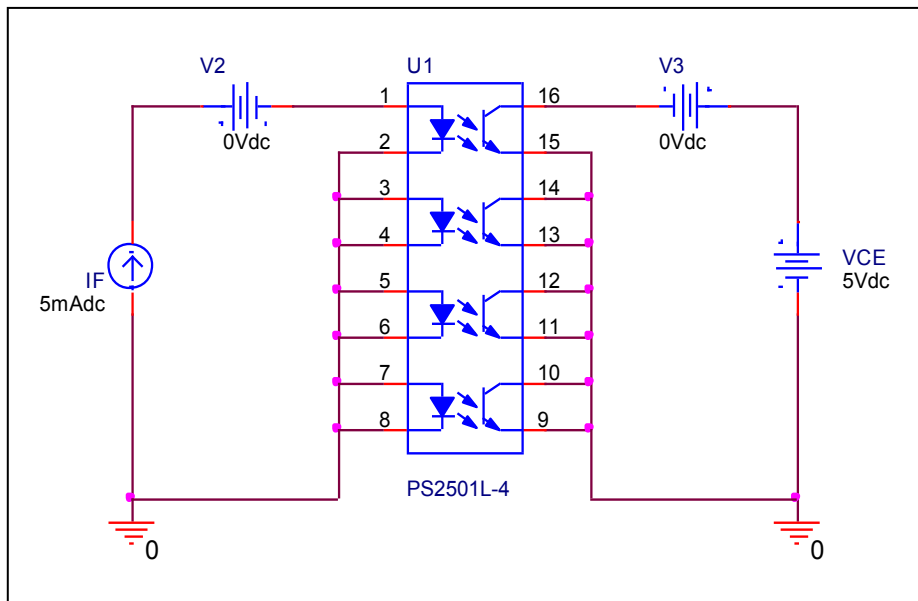


Comparison Table

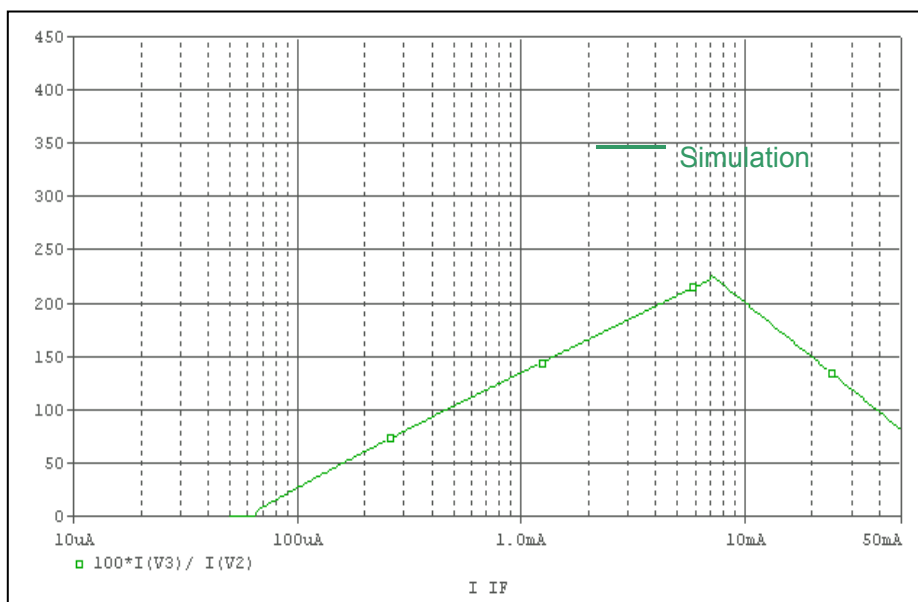
	Measurement	Simulation	% Error
Vce(sat) (V)	0.3	0.299	-0.333

CTR(Current Transfer Ratio) Characteristics

Evaluation Circuit



Simulation result

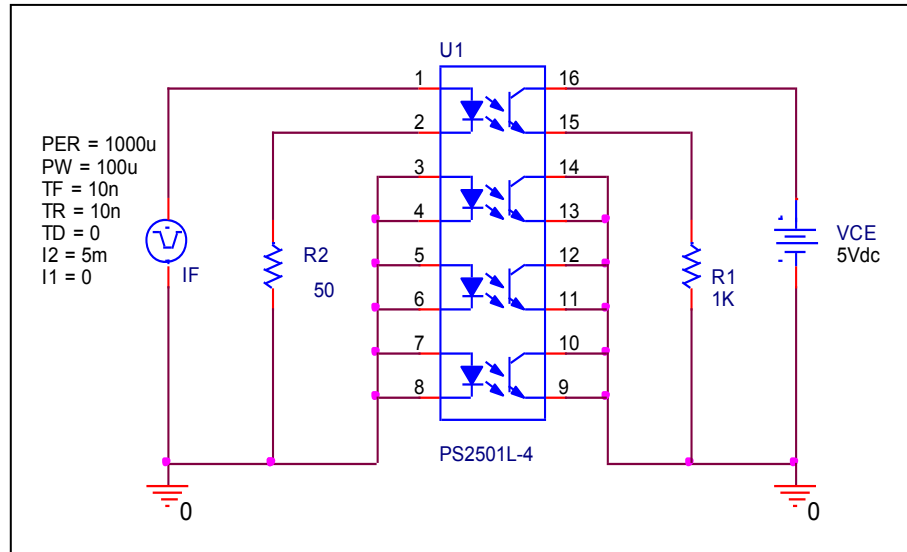


Comparison Table

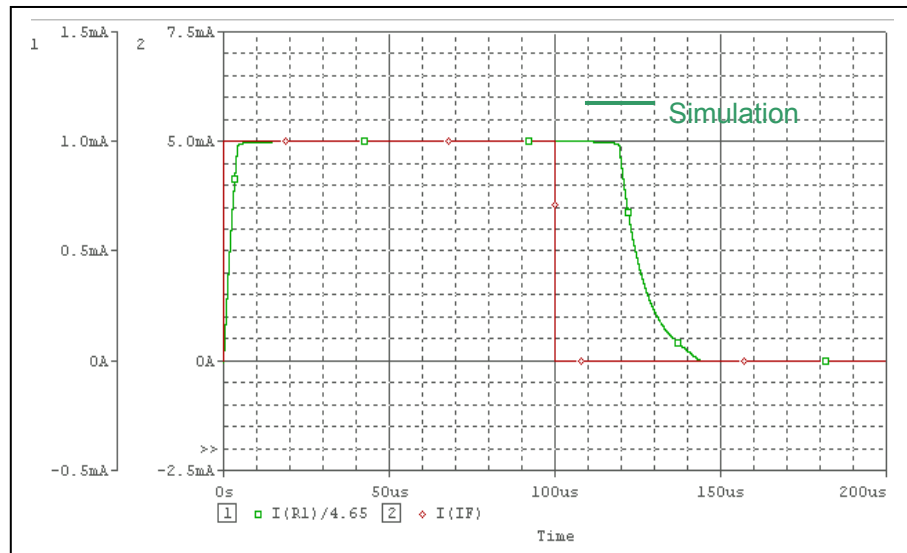
If(mA)	CTR(%)		% Error
	Measurement	Simulation	
0.1	27.0	26.467	-1.974
0.2	59.0	60.415	2.398
0.5	98.2	103.219	5.111
1.0	129.0	134.764	4.468
2.0	158.0	165.336	4.643
5.0	207.0	206.938	-0.030
10.0	205.0	200.280	-2.302
20.0	150.0	148.833	-0.778
50.0	80.0	80.794	0.992

Switching Time Characteristics

Evaluation Circuit



Simulation result

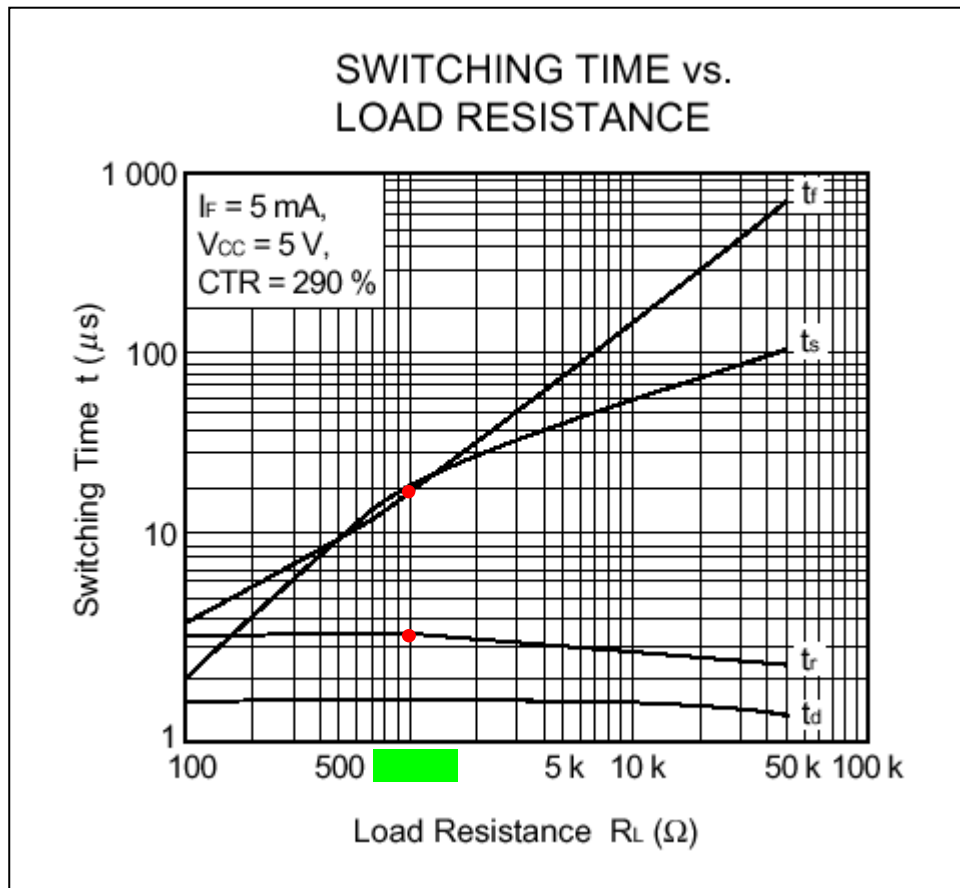


Comparison Table

IF=5mA, Vcc=5V,RL=1K	Measurement	Simulation	% Error
tr(us)	3.4	3.405	0.147
tf (us)	17.0	16.277	-4.253
ts (us)	20.0	19.954	-0.230

Switching Time Characteristics

Reference



$t_r = 3.4(\mu\text{s})$

$t_f = 17(\mu\text{s})$

$t_s = 20(\mu\text{s})$

Conditions: $I_F = 5\text{mA}$, $V_{CC} = 5\text{V}$