Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPCF8102
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

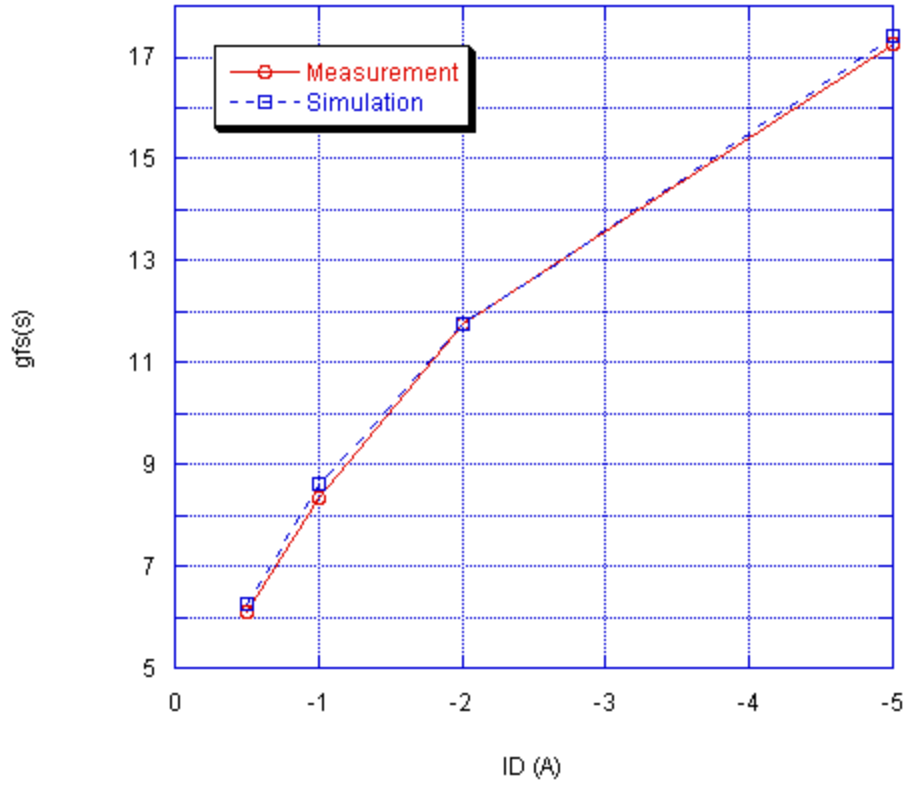
Bee Technologies Inc.

MOSFET MODEL

Pspice model parameter	Model description
LEVEL	
L	Channel Length
W	Channel Width
KP	Transconductance
RS	Source Ohmic Resistance
RD	Ohmic Drain Resistance
VTO	Zero-bias Threshold Voltage
RDS	Drain-Source Shunt Resistance
TOX	Gate Oxide Thickness
CGSO	Zero-bias Gate-Source Capacitance
CGDO	Zero-bias Gate-Drain Capacitance
CBD	Zero-bias Bulk-Drain Junction Capacitance
MJ	Bulk Junction Grading Coefficient
PB	Bulk Junction Potential
FC	Bulk Junction Forward-bias Capacitance Coefficient
RG	Gate Ohmic Resistance
IS	Bulk Junction Saturation Current
N	Bulk Junction Emission Coefficient
RB	Bulk Series Resistance
PHI	Surface Inversion Potential
GAMMA	Body-effect Parameter
DELTA	Width effect on Threshold Voltage
ETA	Static Feedback on Threshold Voltage
THETA	Modility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Transconductance Characteristic

Circuit Simulation Result

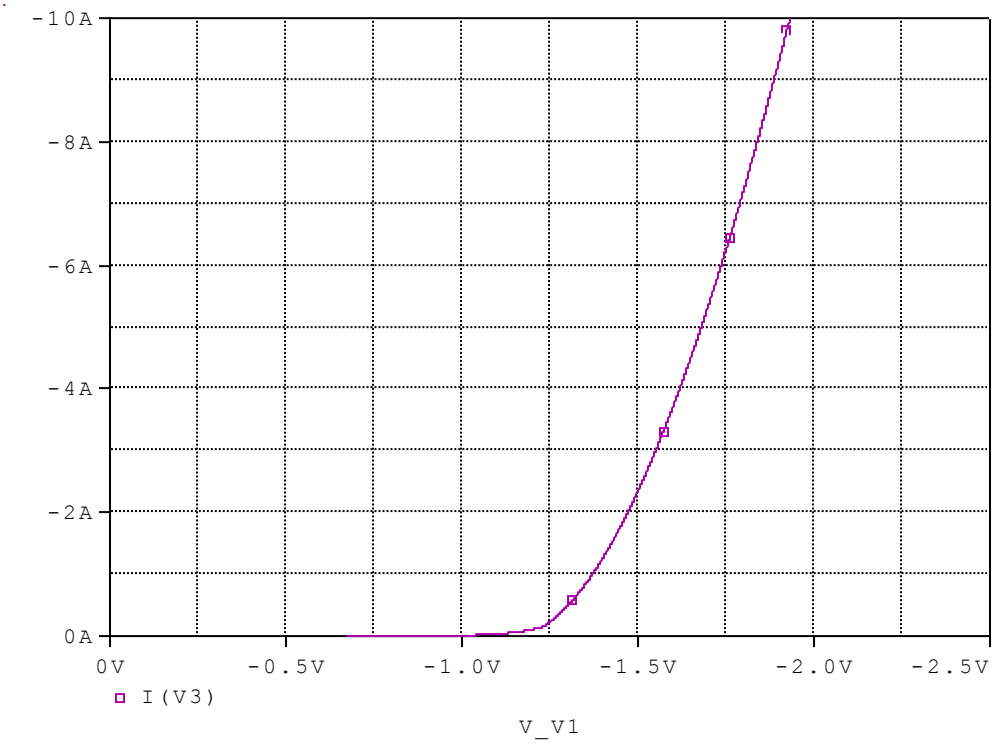


Comparison table

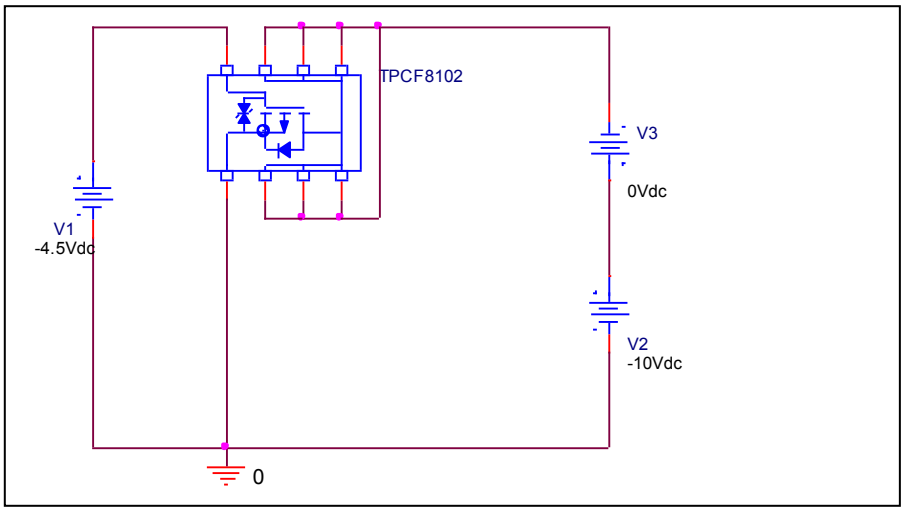
Id(A)	gfs		Error(%)
	Measurement	Simulation	
-0.500	6.097	6.250	2.509
-1.000	8.333	8.621	3.452
-2.000	11.765	11.765	-0.002
-5.000	17.240	17.422	1.053

Vgs-Id Characteristic

Circuit Simulation result

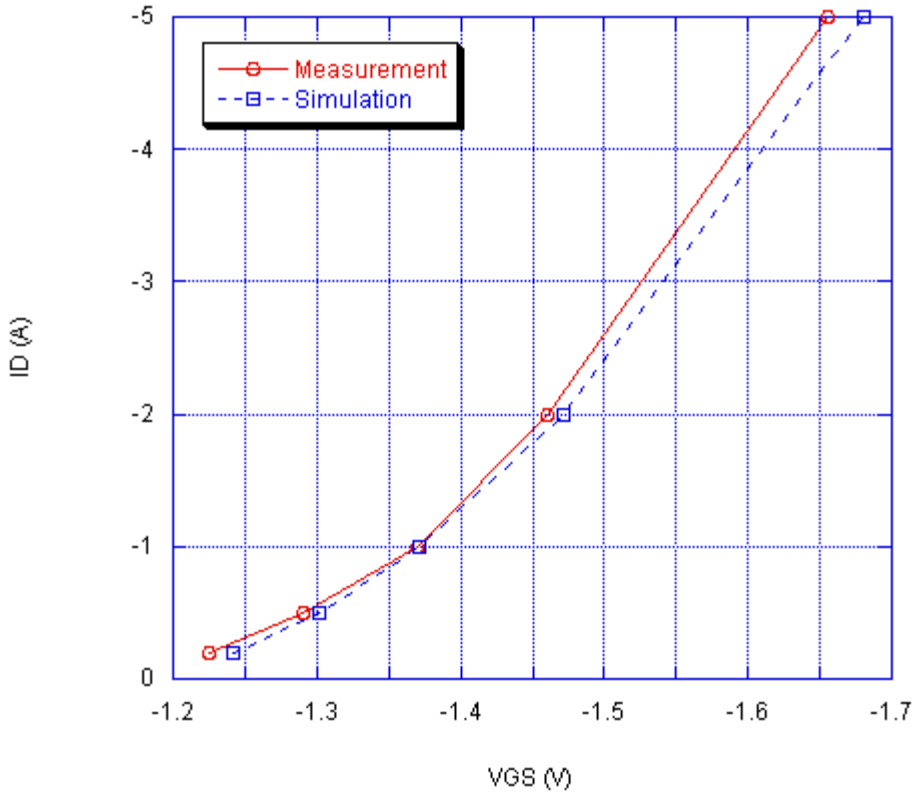


Evaluation circuit



Comparison Graph

Circuit Simulation Result

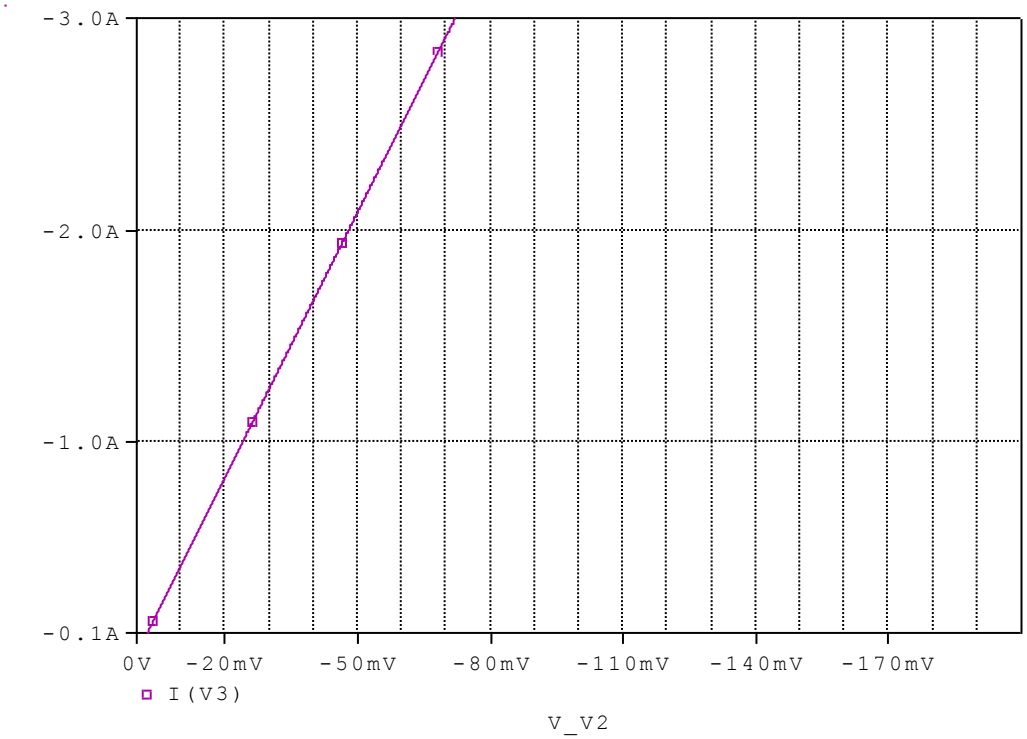


Simulation Result

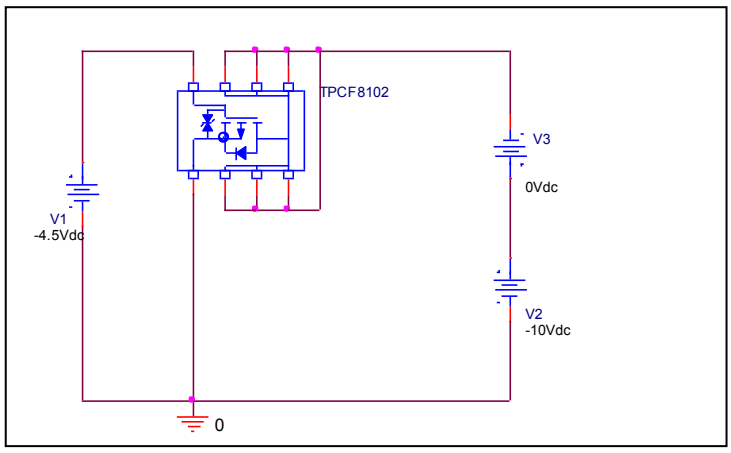
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
-0.200	-1.225	-1.242	1.412
-0.500	-1.290	-1.302	0.922
-1.000	-1.370	-1.371	0.044
-2.000	-1.460	-1.471	0.740
-5.000	-1.655	-1.680	1.498

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

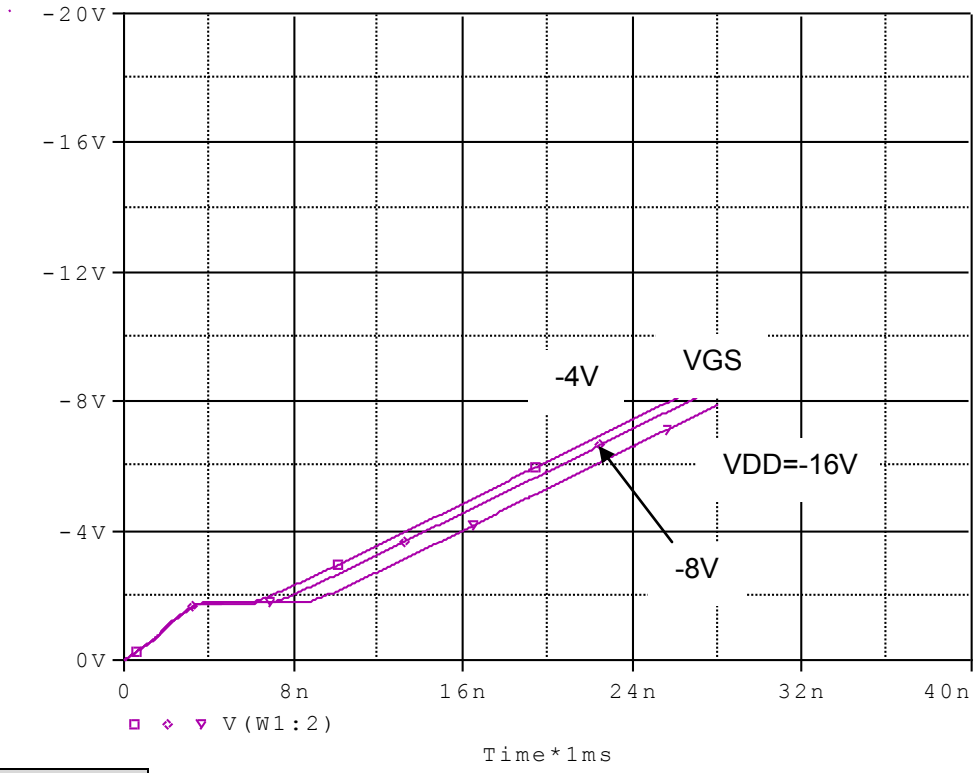


Simulation Result

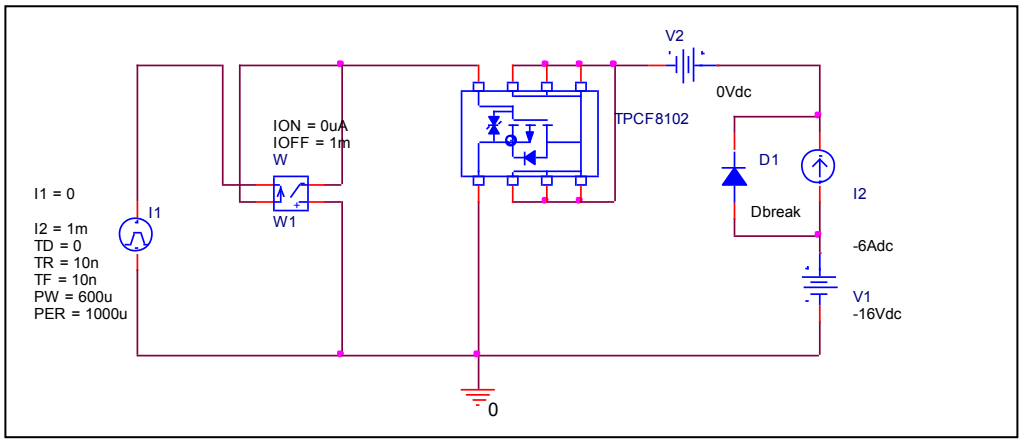
I_D=-3.0A, V_{GS}=-4.5V	Measurement		Simulation		Error (%)
R_{DS} (on)	24.000	mΩ	24.000	mΩ	0.000

Gate Charge Characteristic

Circuit Simulation result



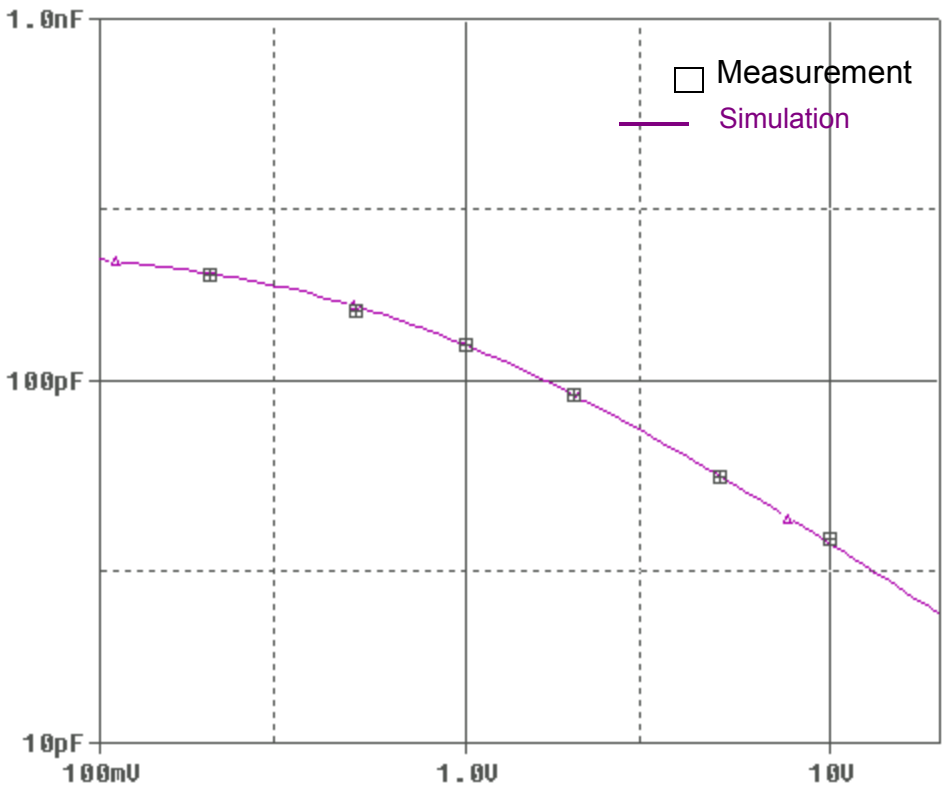
Evaluation circuit



Simulation Result

V_{DD}=-16V,I_D=-6.0A ,V_{GS}=-5V	Measurement		Simulation		Error (%)
Qgs	4.000	nC	4.000	nC	0.000
Qgd	5.000	nC	5.000	nC	0.000
Qg	19.000	nC	19.042	nC	0.221

Capacitance Characteristic

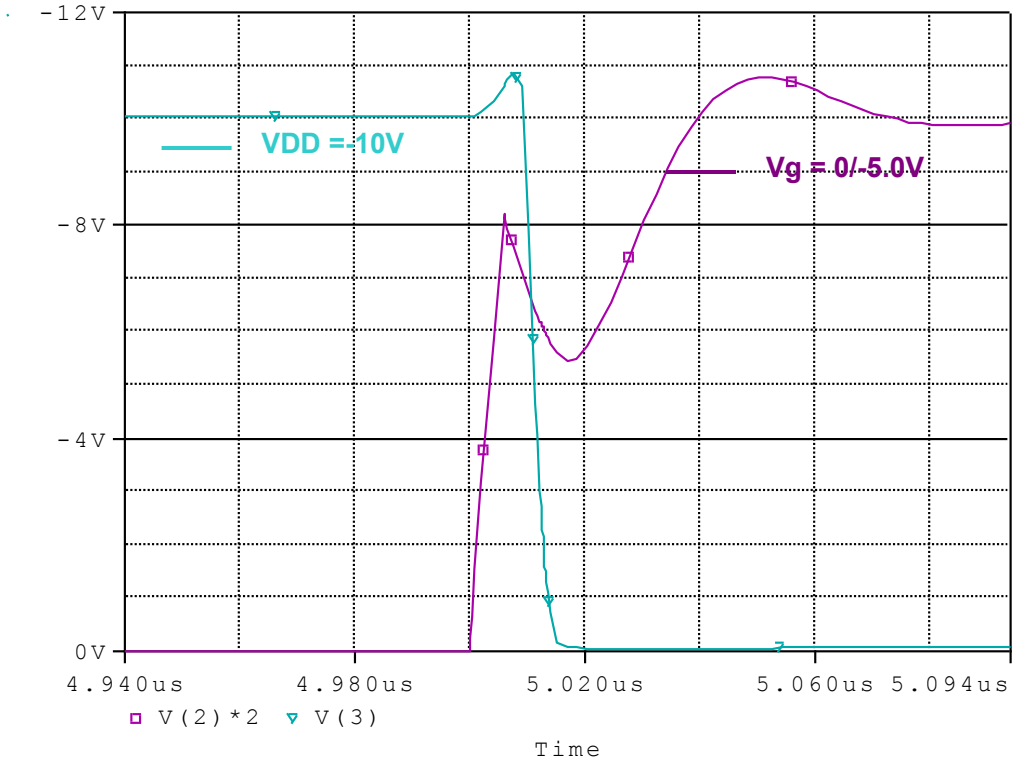


Simulation Result

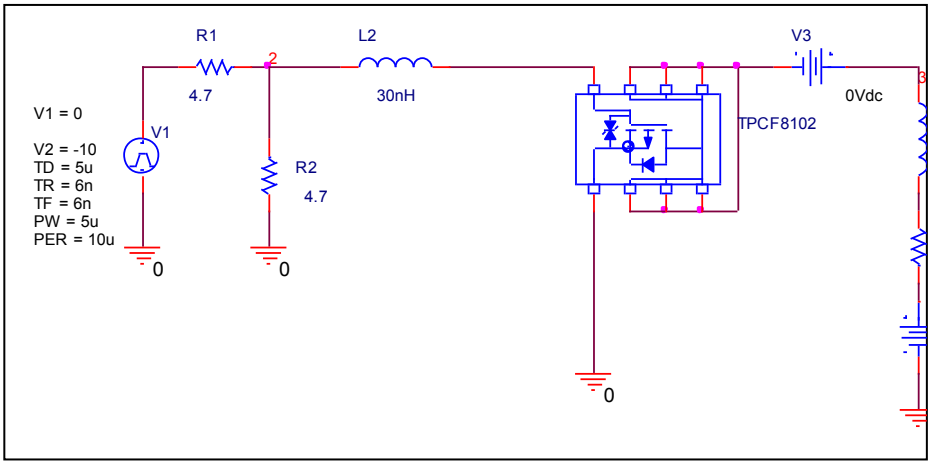
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.200	200.000	198.000	-1.000
0.500	160.700	159.000	-1.058
1.000	127.000	125.000	-1.575
2.000	93.000	91.000	-2.151
5.000	55.000	54.450	-1.000
10.000	37.000	36.000	-2.703
20.000	23.000	22.700	-1.304

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

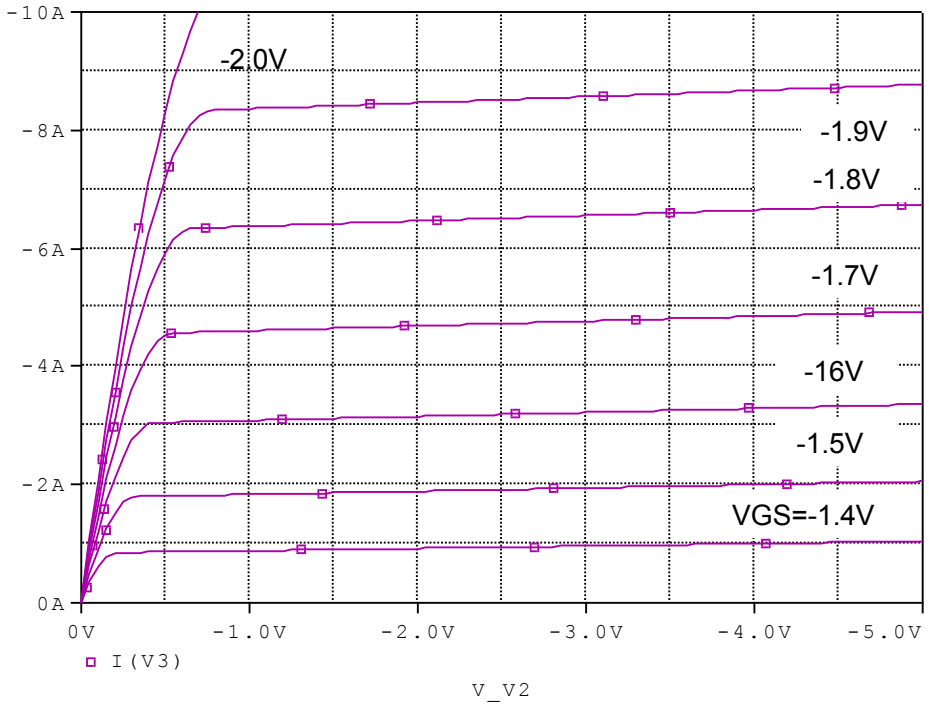


Simulation Result

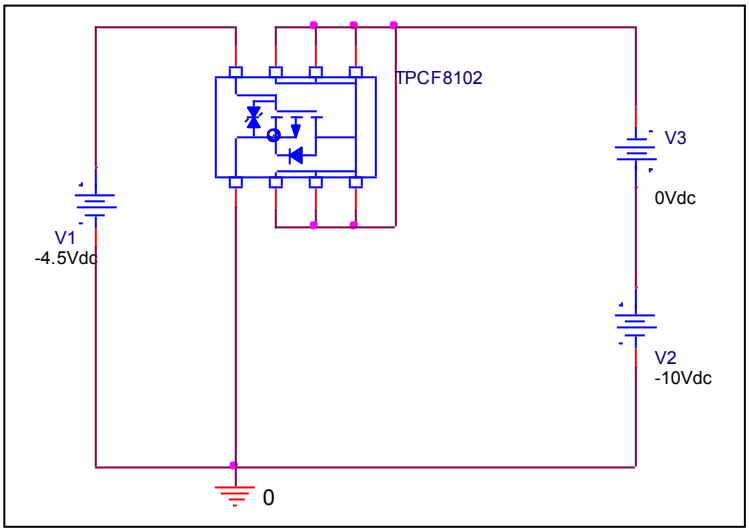
I_D=-3.0A, V_{DD}=-10V V_{GS}=0/-5V	Measurement		Simulation		Error(%)
ton	13.000	ns	13.033	ns	0.254

Output Characteristic

Circuit Simulation result

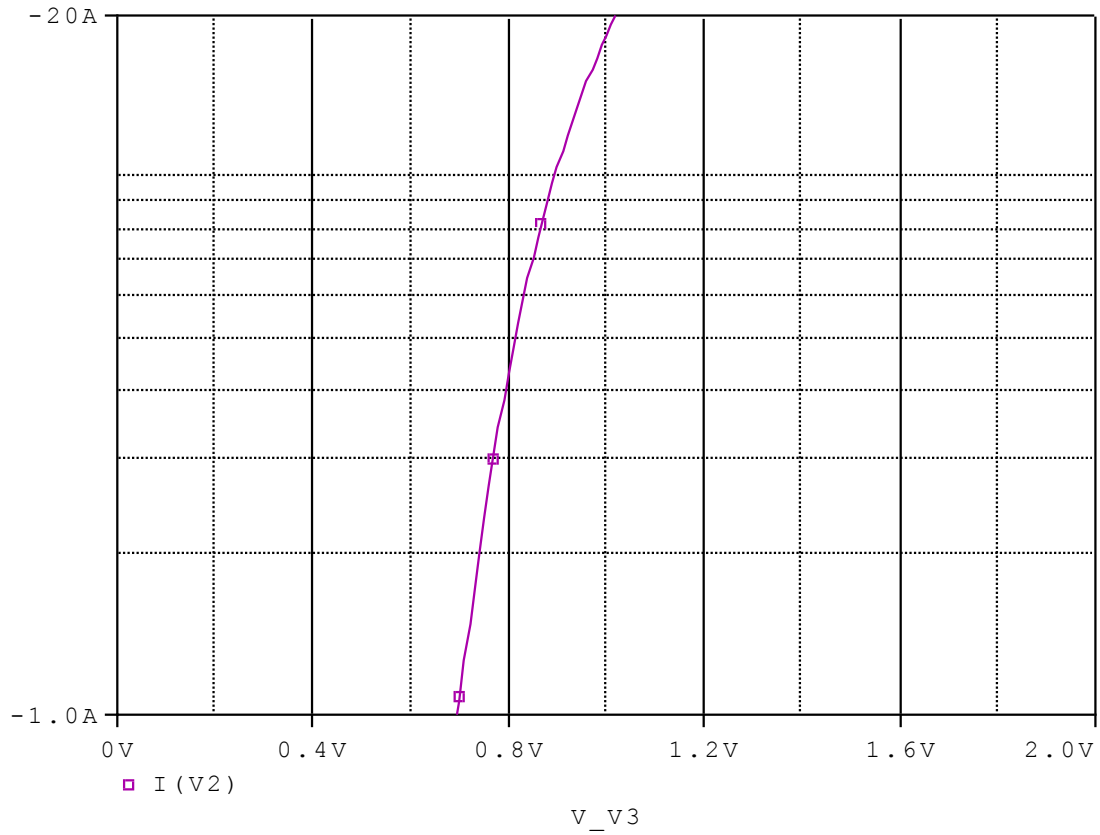


Evaluation circuit

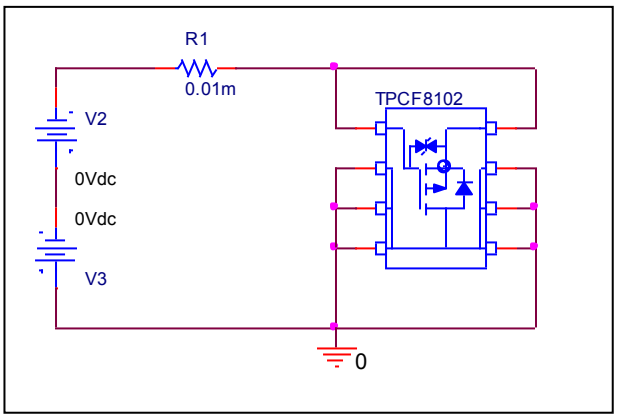


Forward Current Characteristic

Circuit Simulation Result

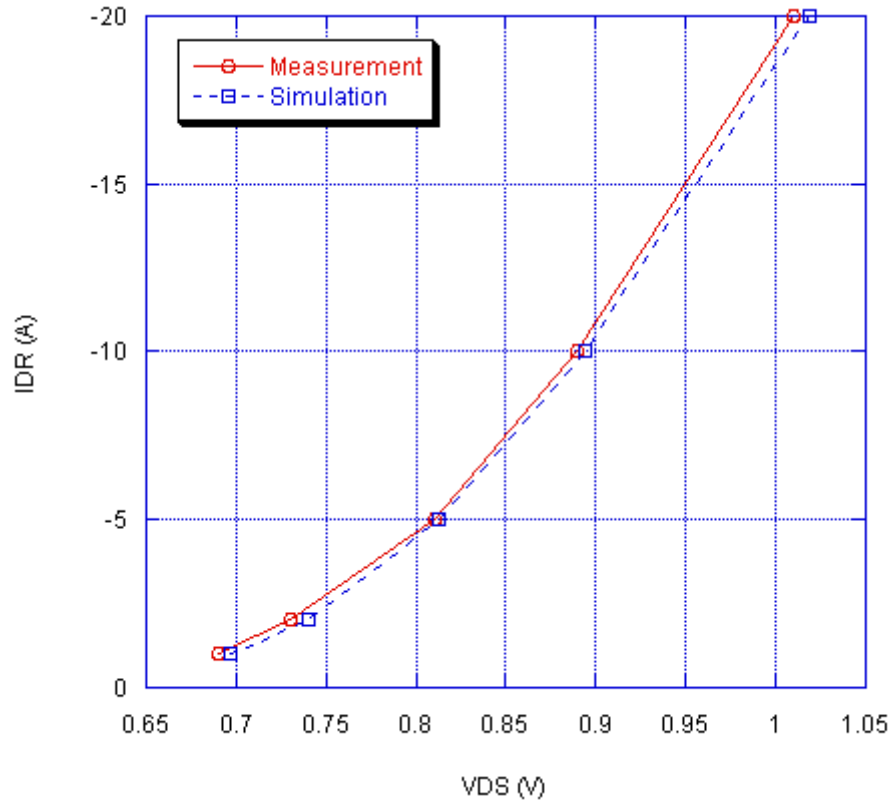


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

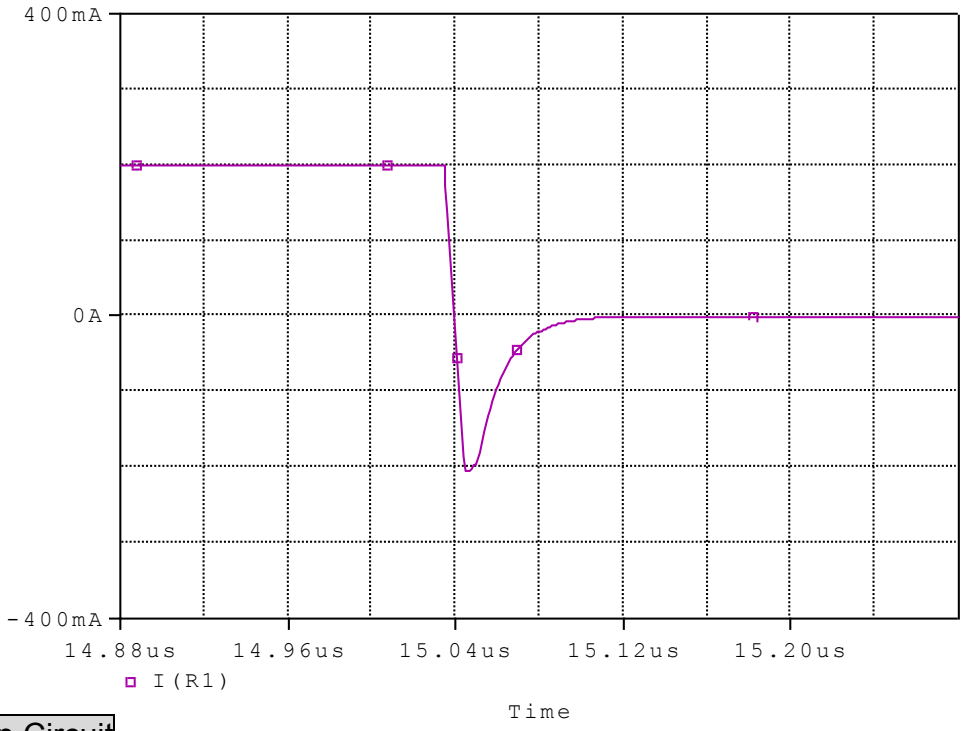


Simulation Result

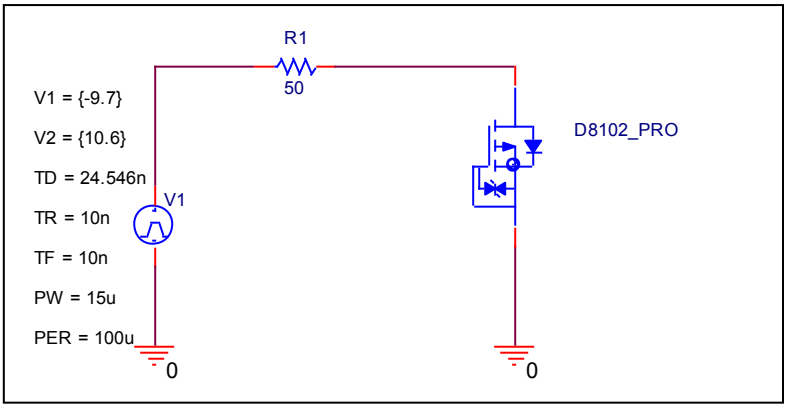
IDR (A)	VDS (V) Measurement	VDS (V) Simulation	%Error
-1.000	0.690	0.697	1.014
-2.000	0.730	0.740	1.370
-5.000	0.810	0.813	0.370
-10.000	0.890	0.894	0.449
-20.000	1.010	1.019	0.891
-1.000	0.690	0.697	1.014

Reverse Recovery Characteristic

Circuit Simulation Result



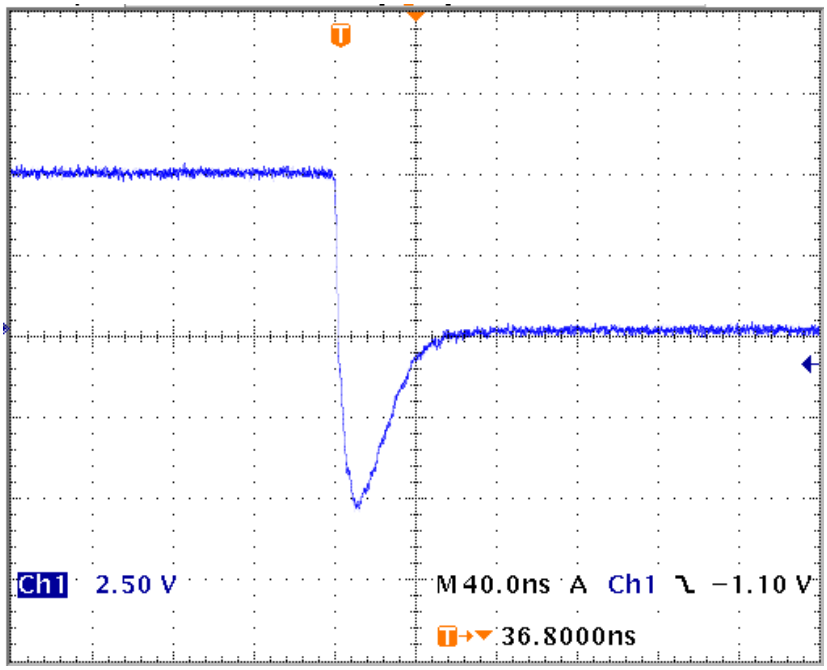
Evaluation Circuit



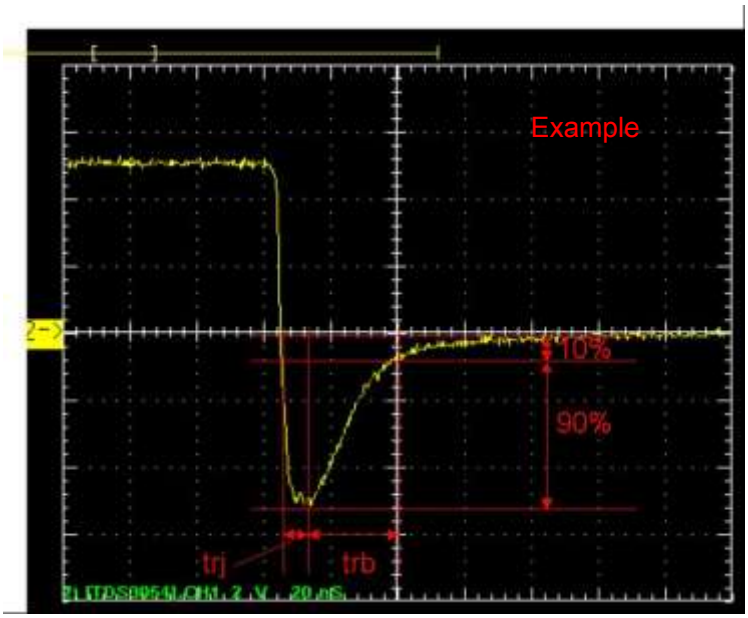
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	**8.800**	**ns**	**8.770**	**ns**	**-0.341**
trb	**31.200**	**ns**	**31.251**	**ns**	**0.163**
trr	**40.000**	**ns**	**40.021**	**ns**	**0.053**

Reverse Recovery Characteristic Reference



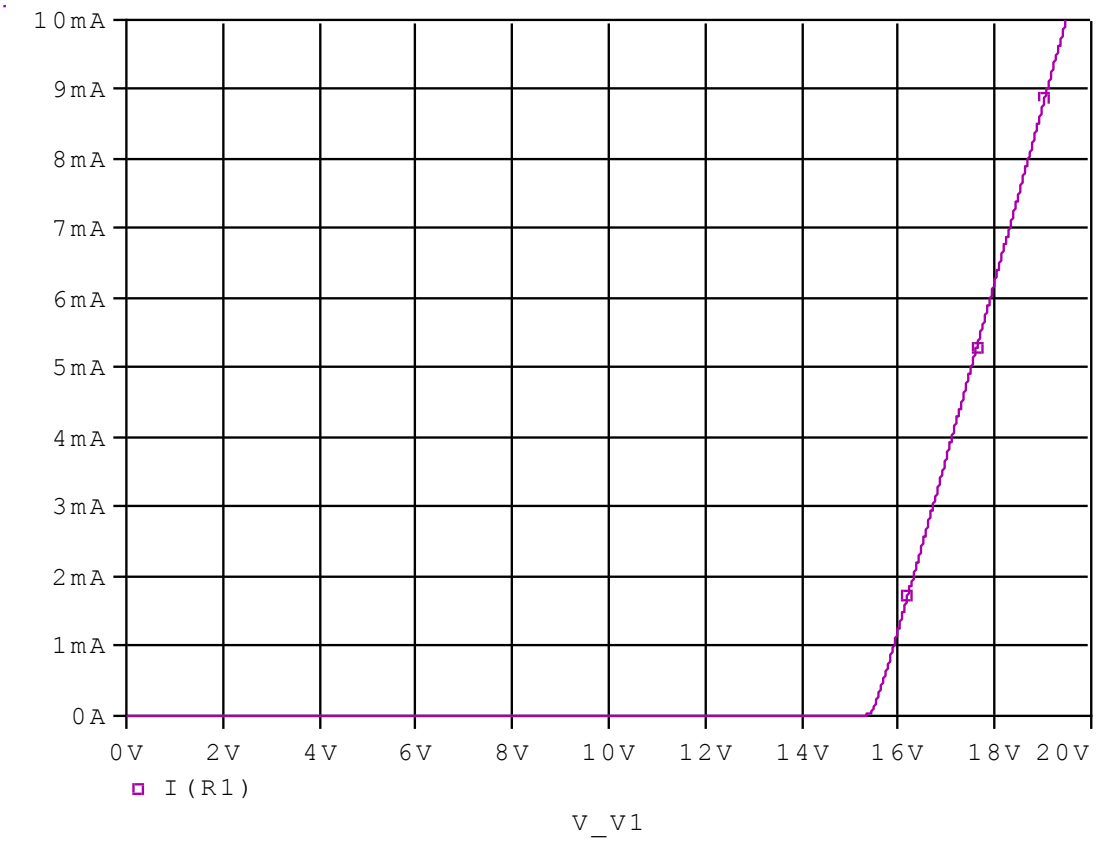
Trj=8.8(ns)
Trb=31.2(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



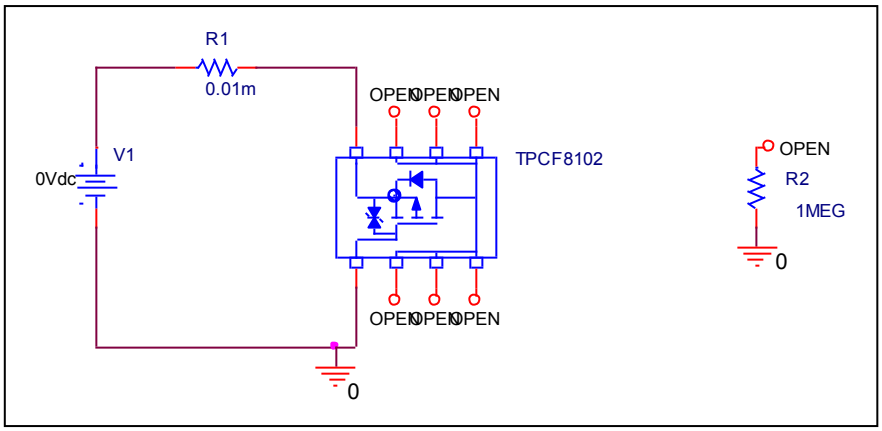
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference