Device Modeling Report

COMPONENTS: MOSFET (Professional)
PART NUMBER: TPCP8302
MANUFACTURER: TOSHIBA
REMARK: P Channel Model
Body Diode (Professional) / ESD Protection Diode

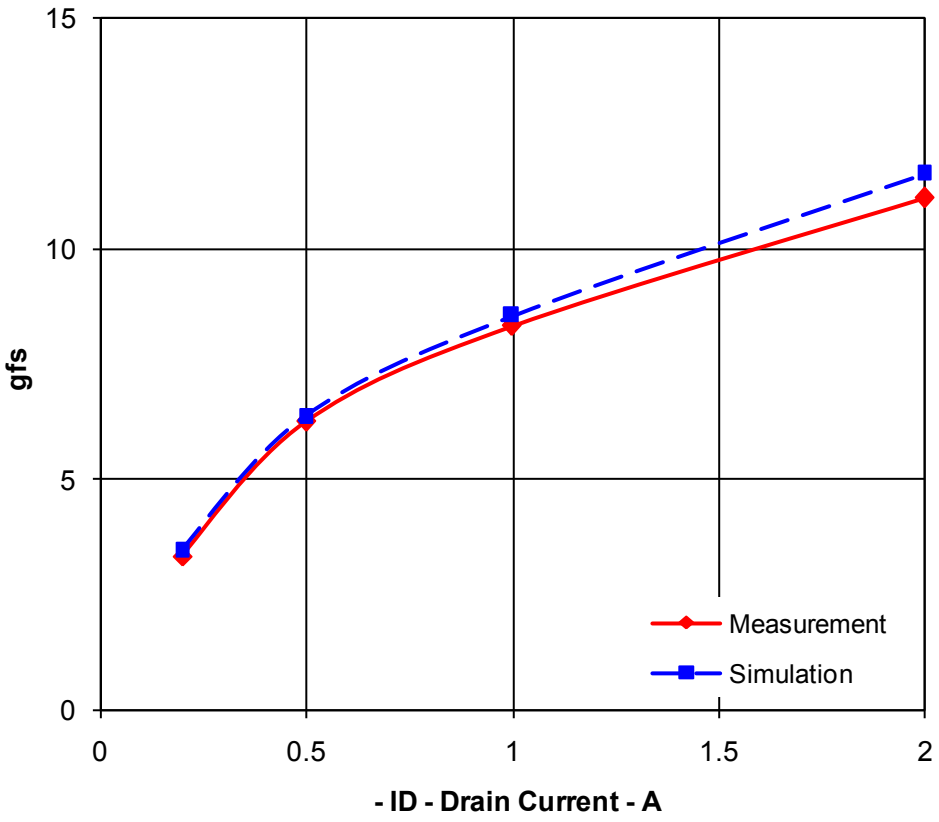
Bee Technologies Inc.

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

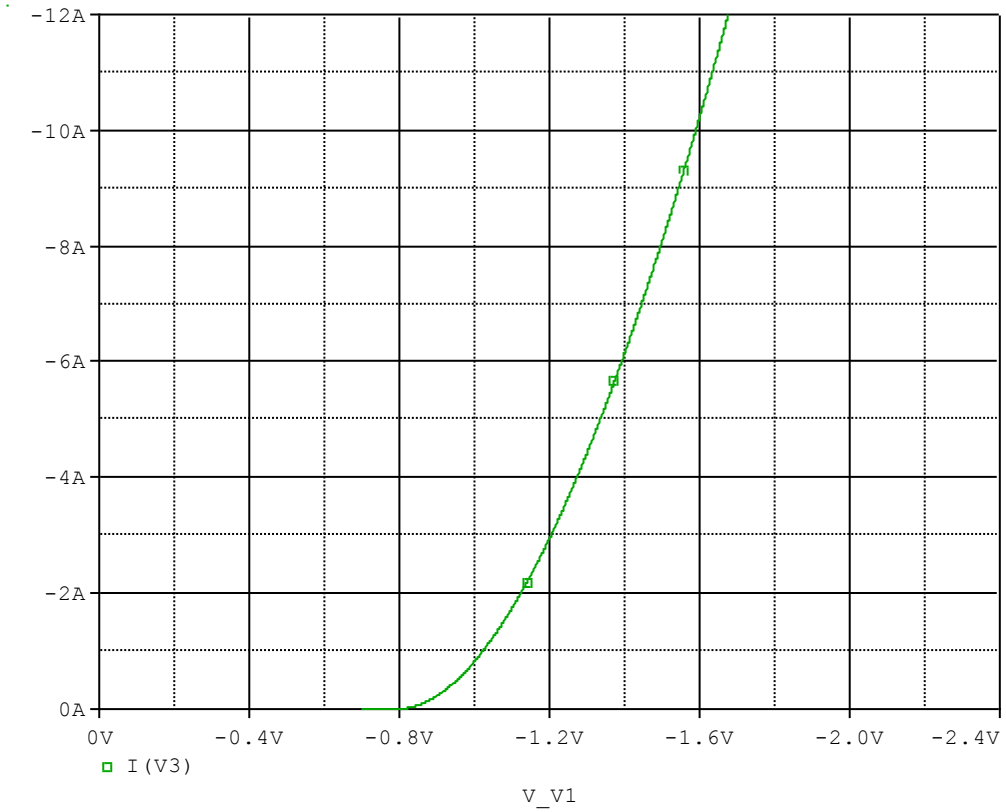


Comparison table

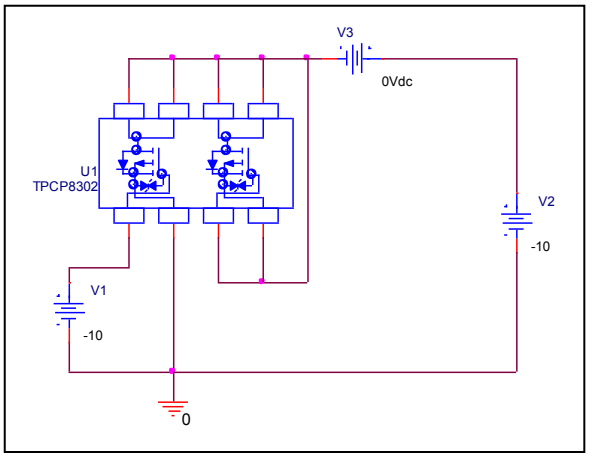
-Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.2	3.333	3.448	3.450
0.5	6.25	6.352	1.632
1	8.333	8.547	2.568
2	11.111	11.628	4.653

Vgs-Id Characteristic

Circuit Simulation result

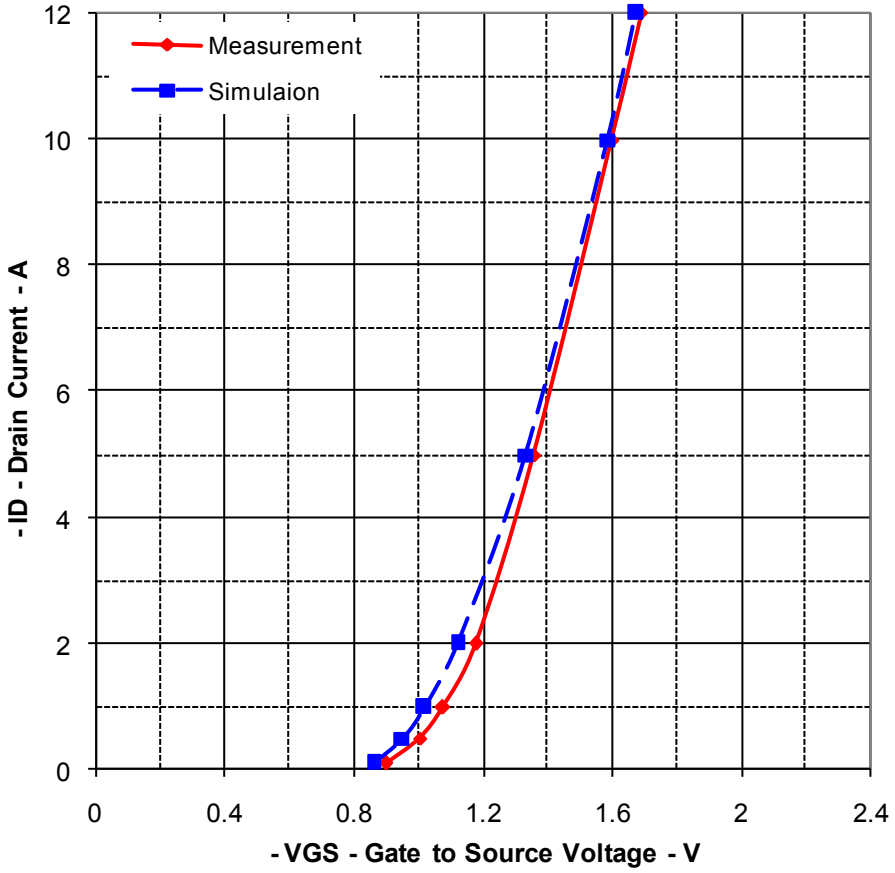


Evaluation circuit



Comparison Graph

Circuit Simulation Result

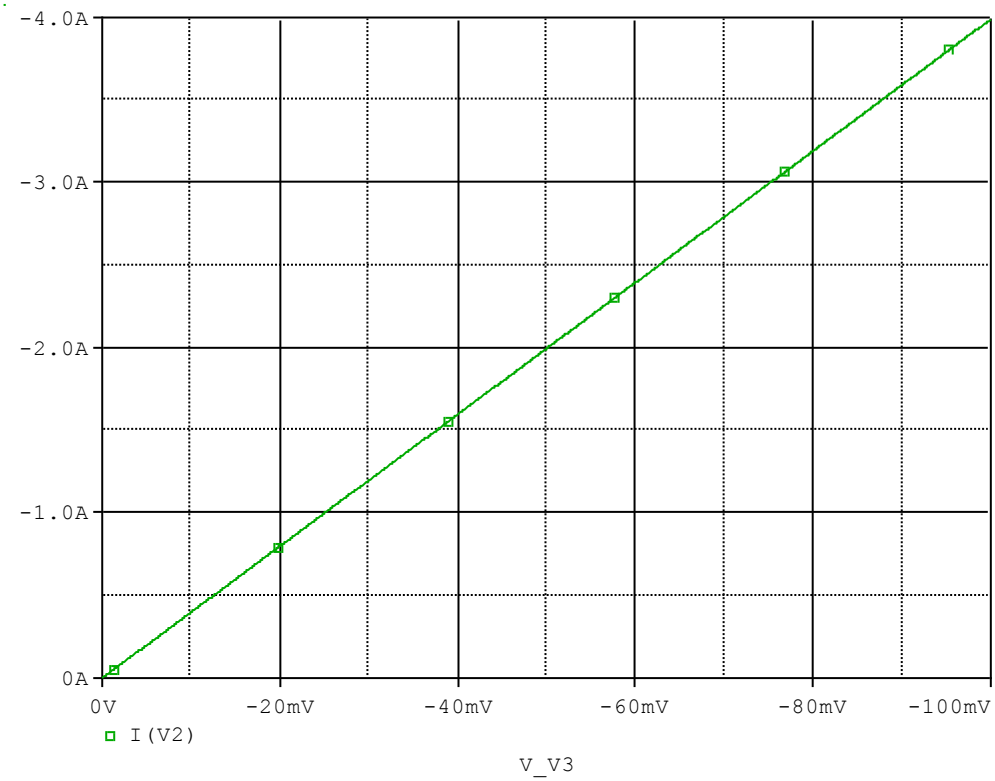


Simulation Result

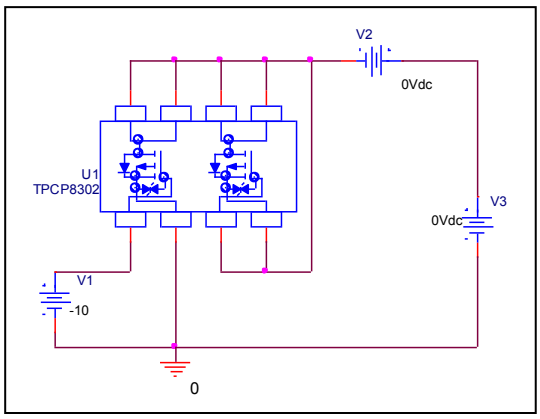
$-I_D$(A)	$-V_{GS}$(V)		Error (%)
	Measurement	Simulation	
0.1	0.900	0.863	-4.111
0.5	1.005	0.955	-4.975
1	1.076	1.023	-4.926
2	1.180	1.123	-4.831
5	1.360	1.336	-1.765
10	1.600	1.590	-0.625
12	1.690	1.677	-0.769

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

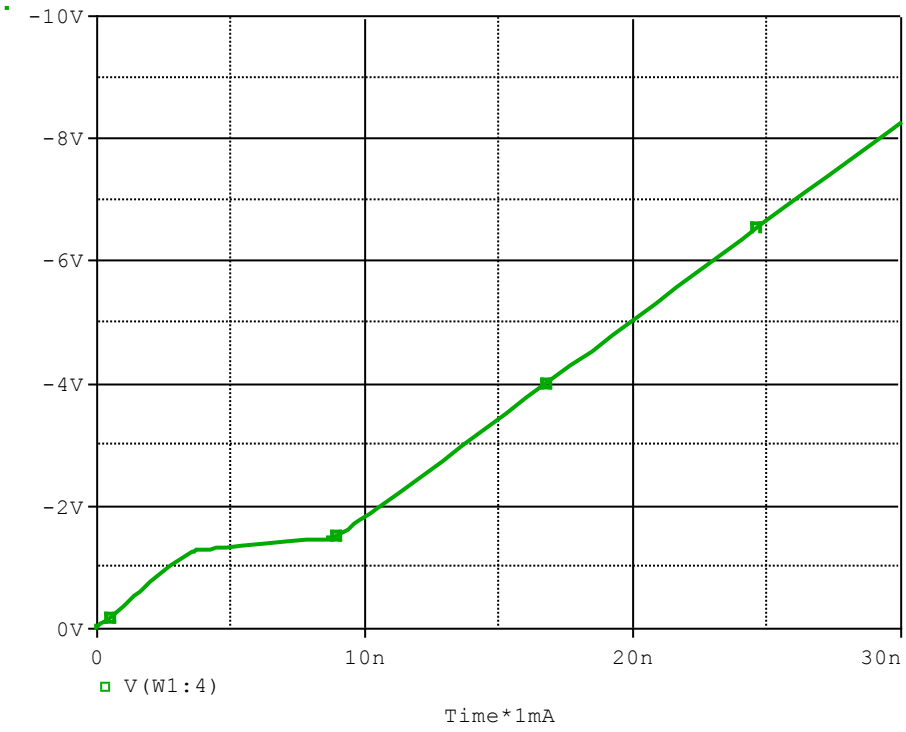


Simulation Result

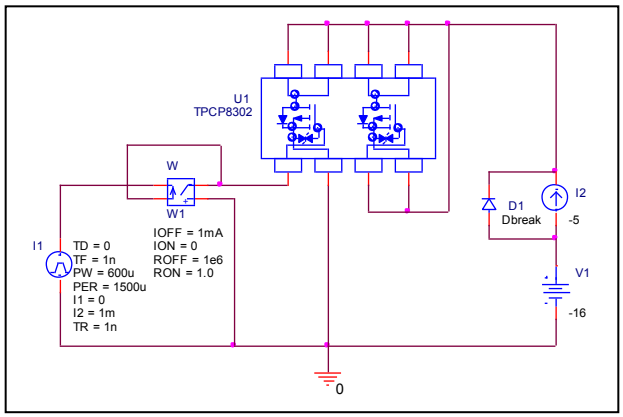
I_D=-2.5, V_{GS}=-4V	Measurement		Simulation		Error (%)
R_{DS} (on)	25.000	mΩ	25.020	mΩ	0.080

Gate Charge Characteristic

Circuit Simulation result



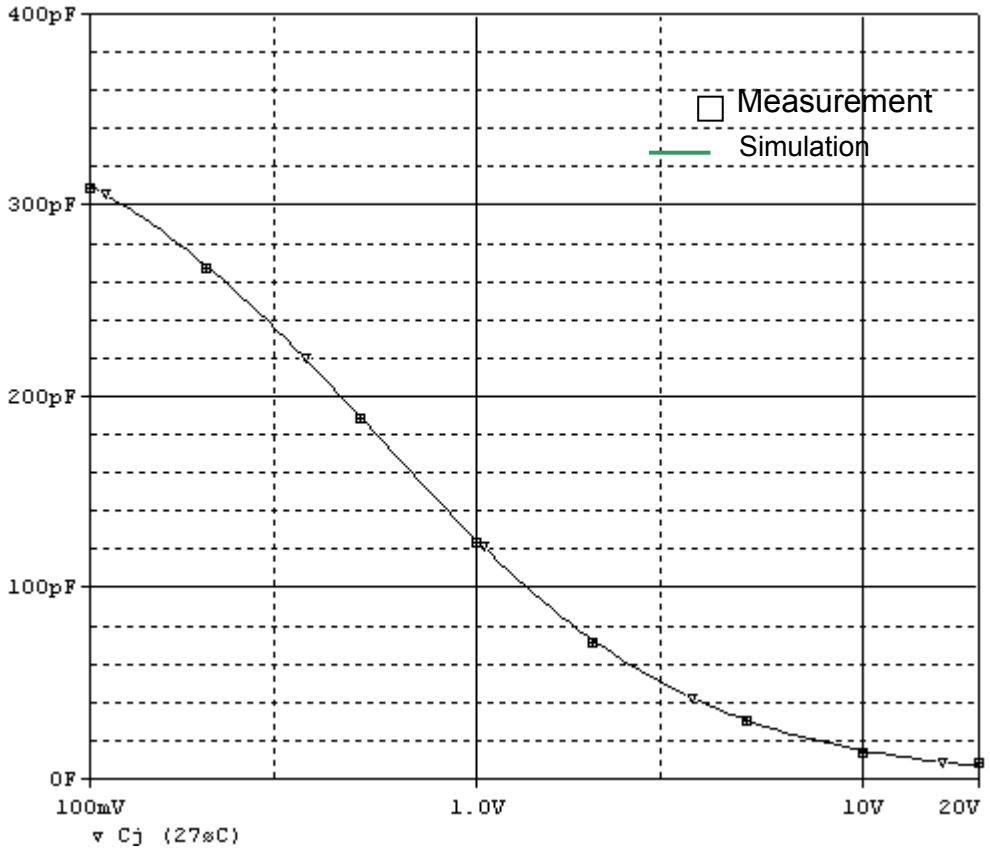
Evaluation circuit



Simulation Result

V_{DD}=-16V,I_D=-5A ,V_{GS}=-5V	Measurement		Simulation		Error (%)
Qgs	3.600	nC	3.605	nC	0.139
Qgd	5.100	nC	5.105	nC	0.098
Qg	20.000	nC	20.000	nC	0.000

Capacitance Characteristic

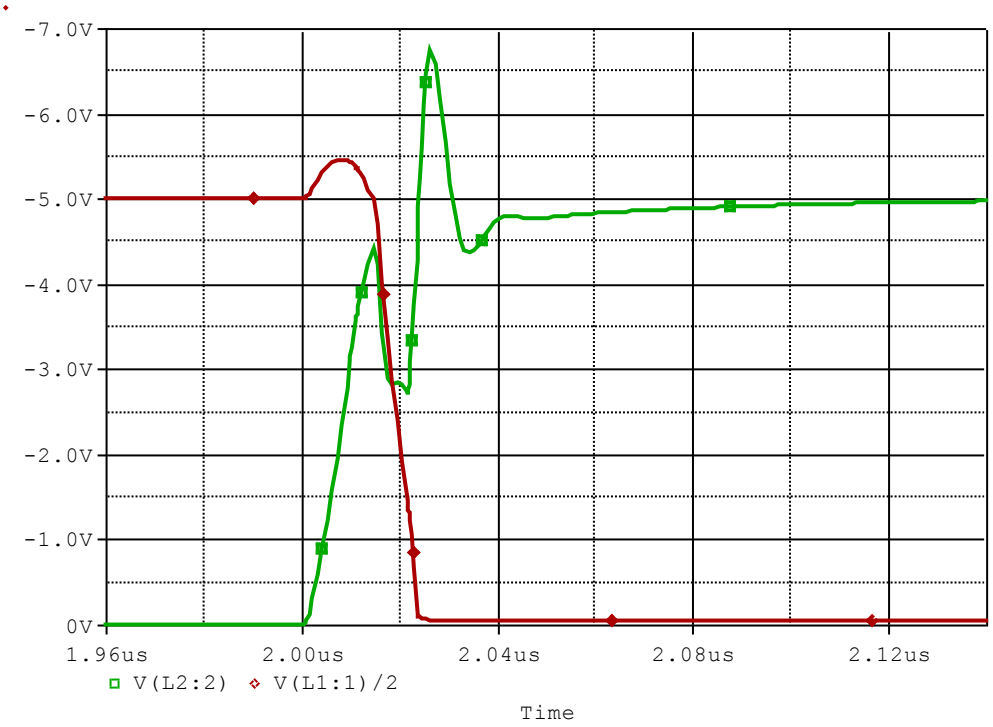


Simulation Result

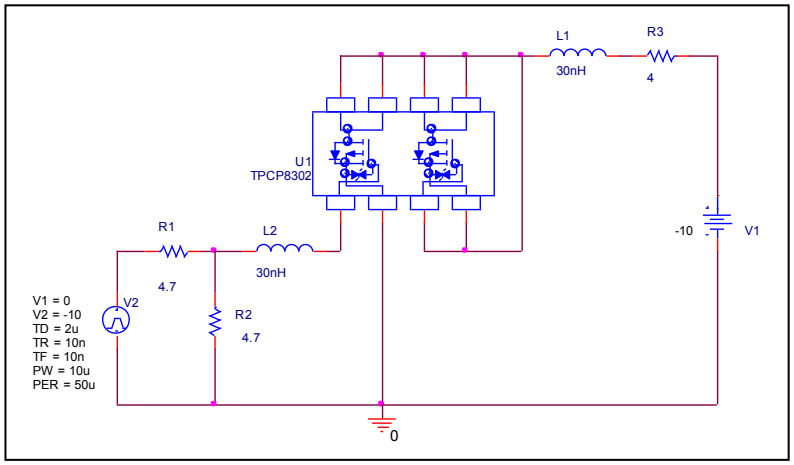
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	310.000	309.000	-0.323
0.2	268.000	268.500	0.187
0.5	190.000	190.000	0.000
1	125.000	126.000	0.800
2	72.000	74.000	2.778
5	31.000	31.000	0.000
10	15.000	15.500	3.333
20	9.000	8.600	-4.444

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

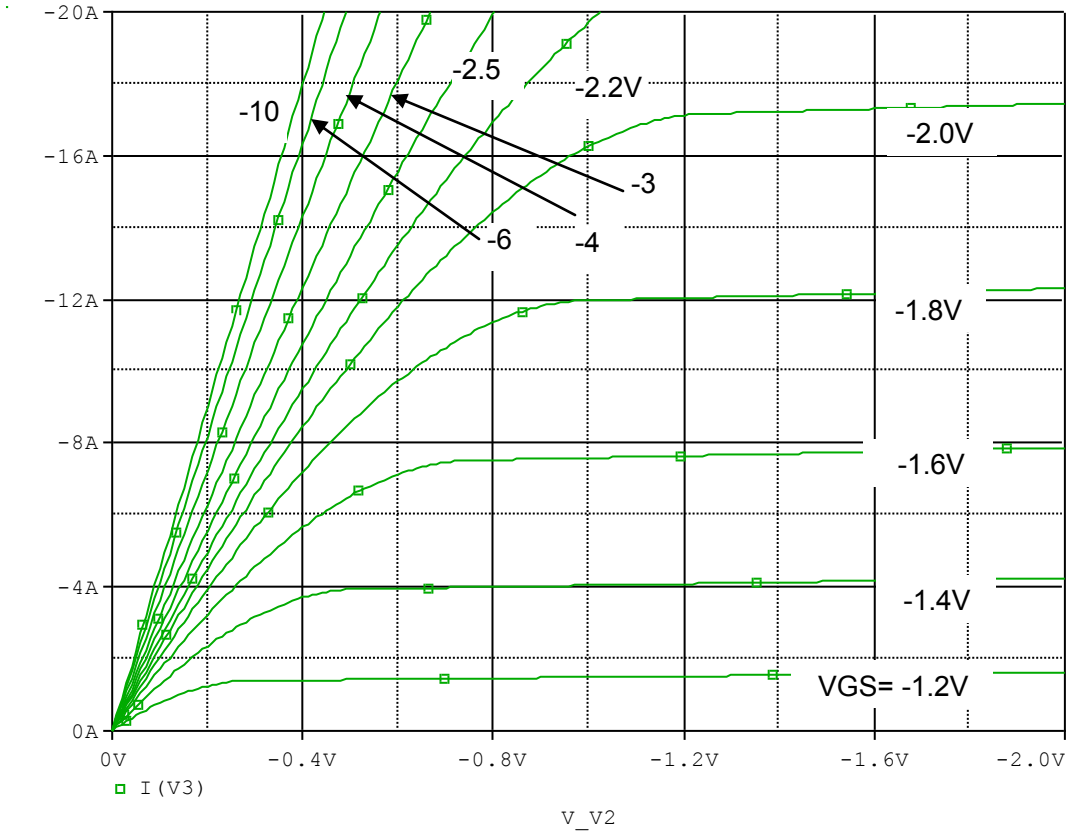


Simulation Result

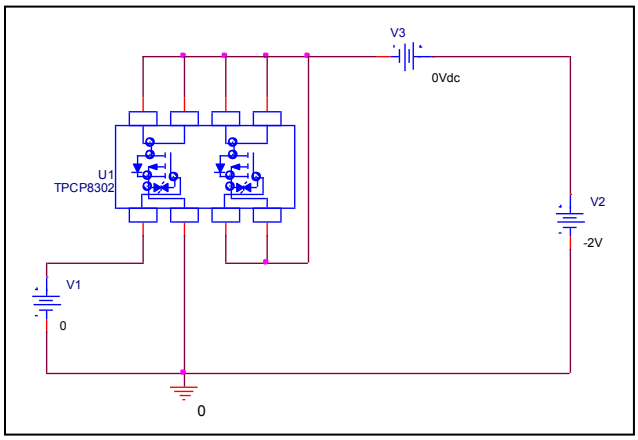
I_D=-2.5A, V_{DD}=-10V V_{GS}=-5V	Measurement		Simulation		Error(%)
ton	20.000	ns	20.089	ns	0.445

Output Characteristic

Circuit Simulation result

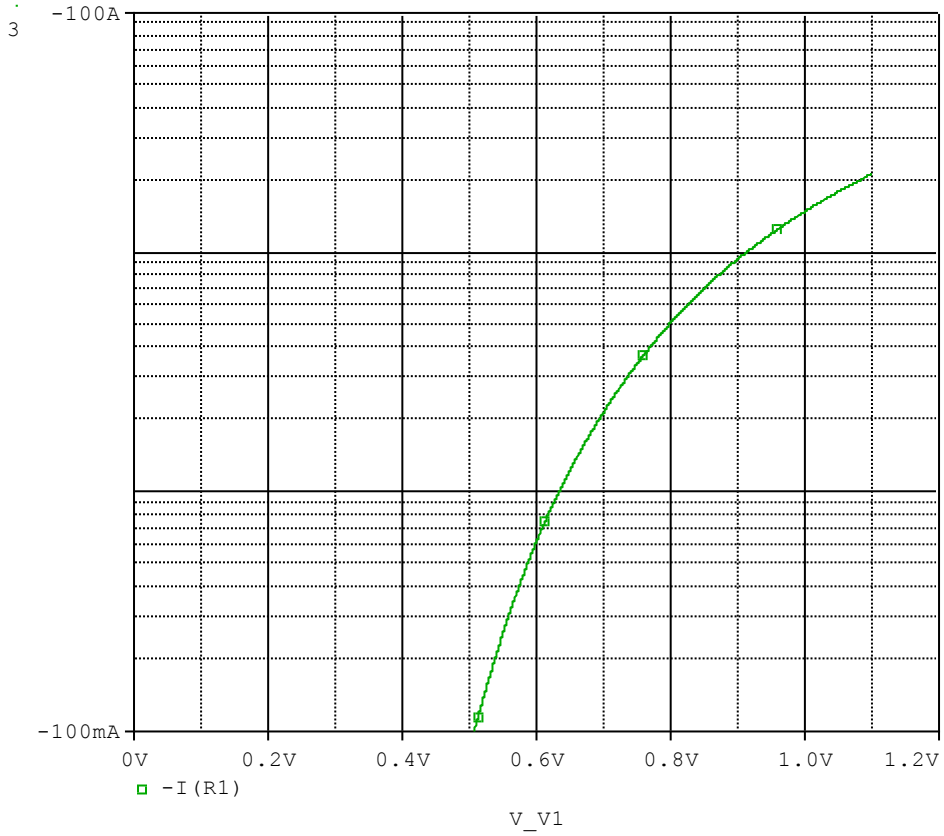


Evaluation circuit

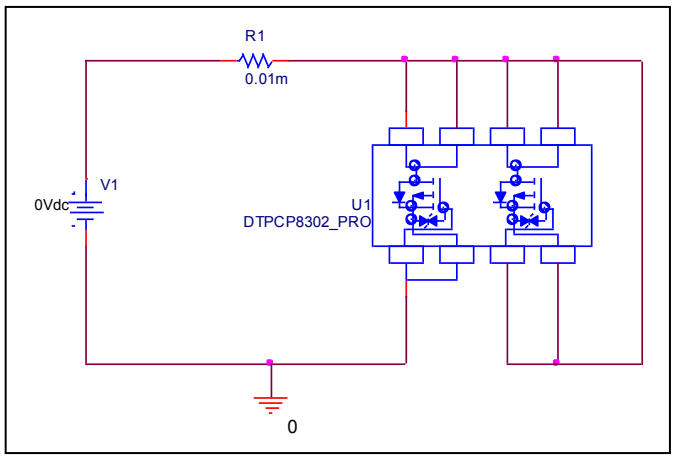


Forward Current Characteristic

Circuit Simulation Result

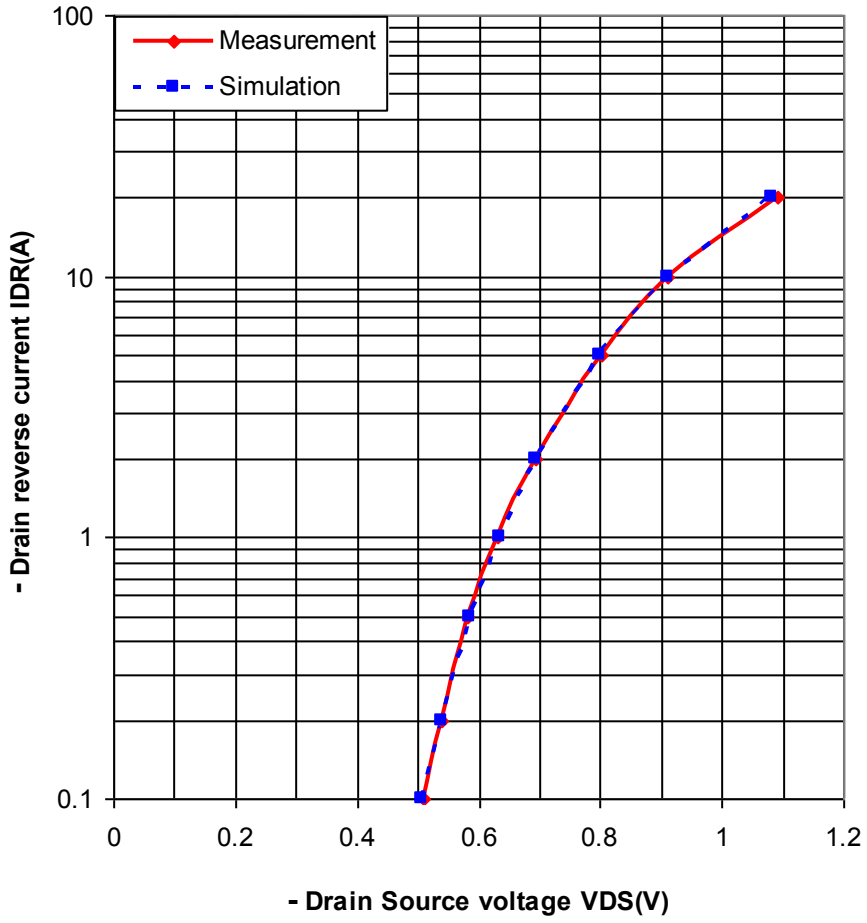


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

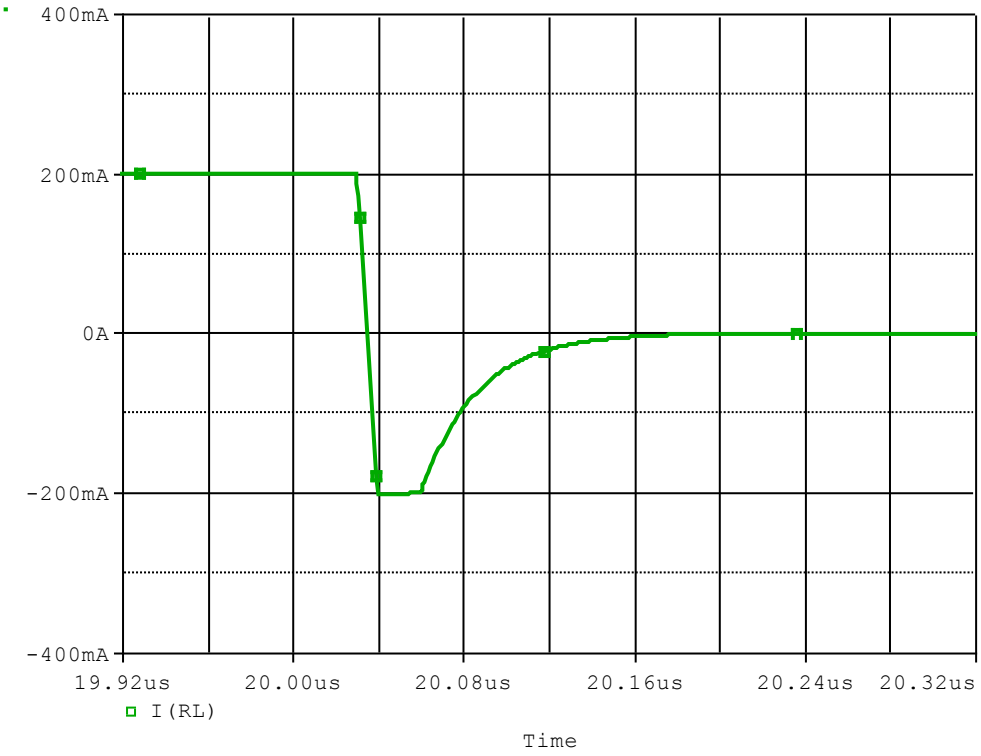


Simulation Result

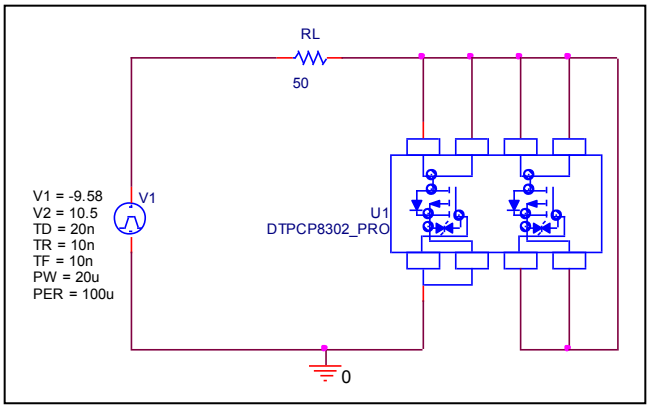
-IDR(A)	-VDS(V) Measurement	-VDS(V) Simulation	%Error
0.100	0.510	0.507	-0.588
0.200	0.540	0.538	-0.370
0.500	0.583	0.586	0.515
1.000	0.630	0.633	0.476
2.000	0.695	0.694	-0.144
5.000	0.803	0.798	-0.623
10.000	0.910	0.912	0.220
20.000	1.090	1.081	-0.826

Reverse Recovery Characteristic

Circuit Simulation Result



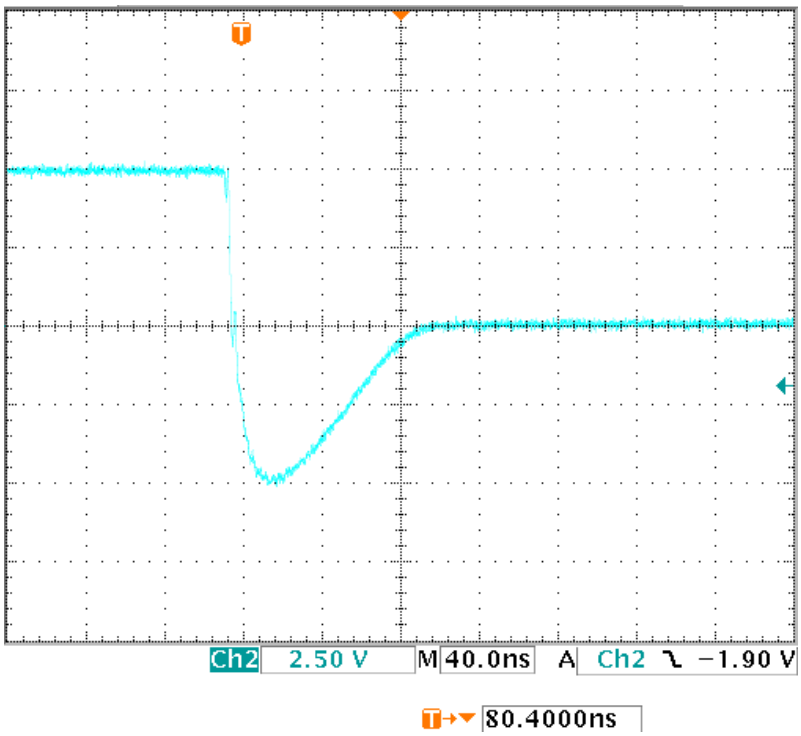
Evaluation Circuit



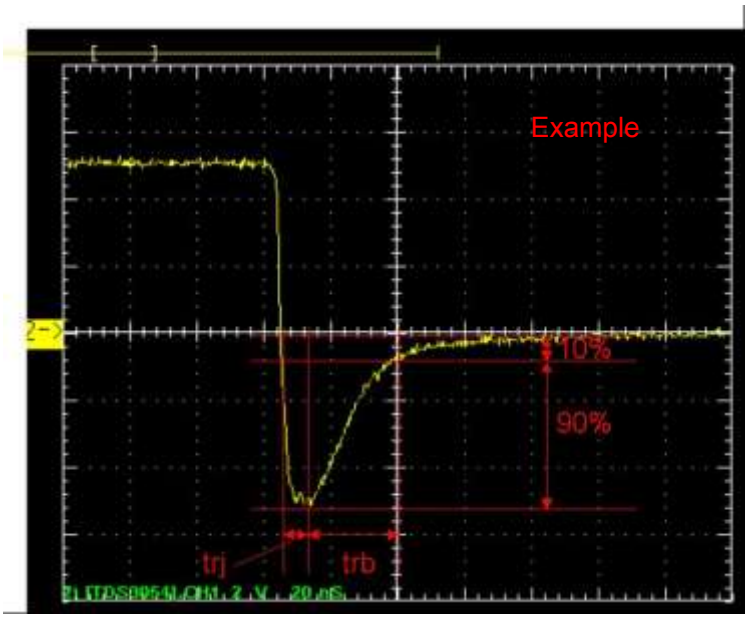
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	24.800	ns	24.889	ns	0.359
trb	60.800	ns	60.702	ns	-0.161
trr	85.600	ns	85.591	ns	-0.011

Reverse Recovery Characteristic Reference



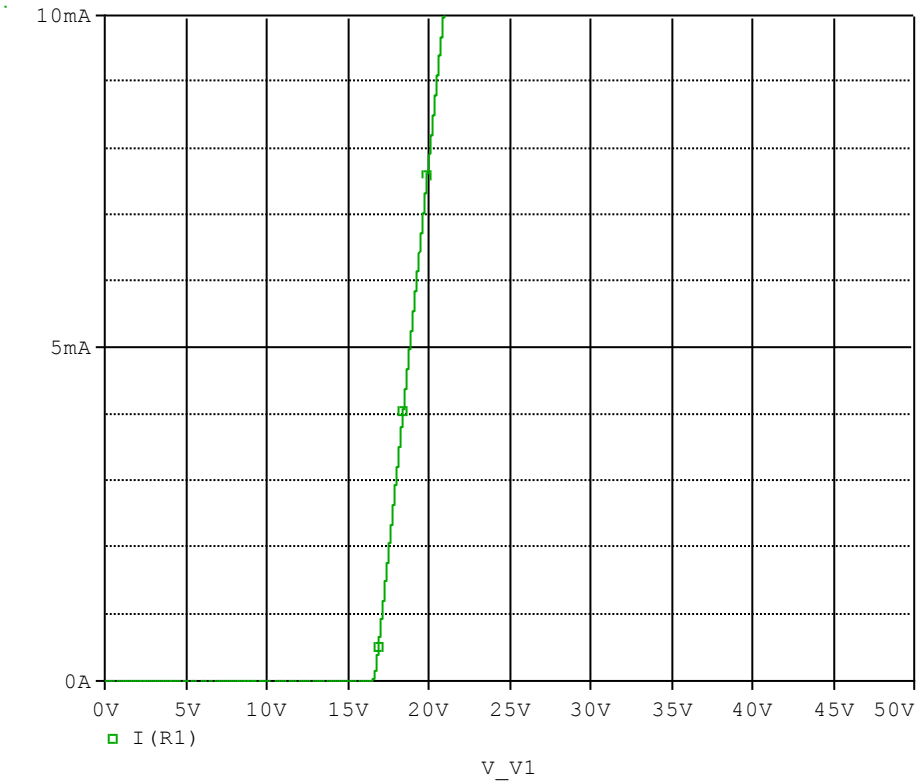
Trj= 24.8(ns)
Trb= 60.8(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



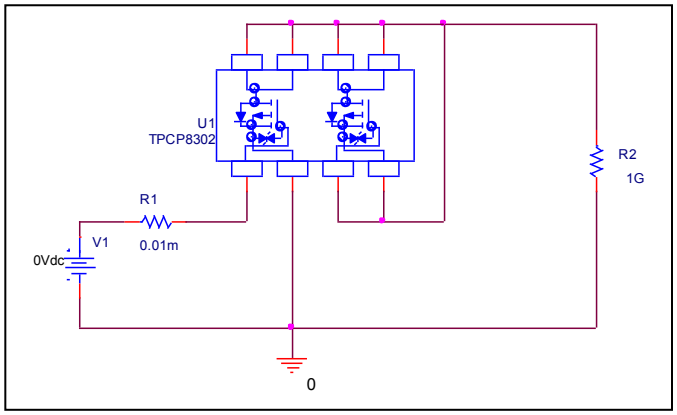
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference