Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPC8110
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

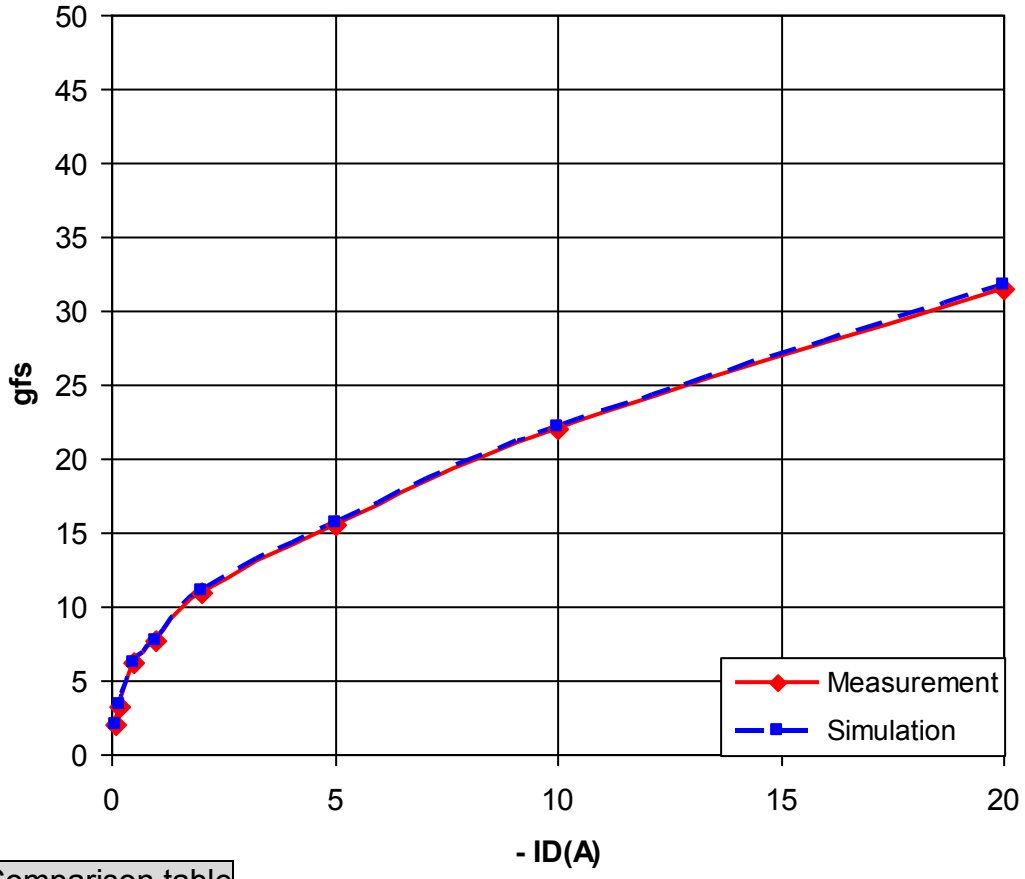
Bee Technologies Inc.

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	Mobility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Transconductance Characteristic

Circuit Simulation Result

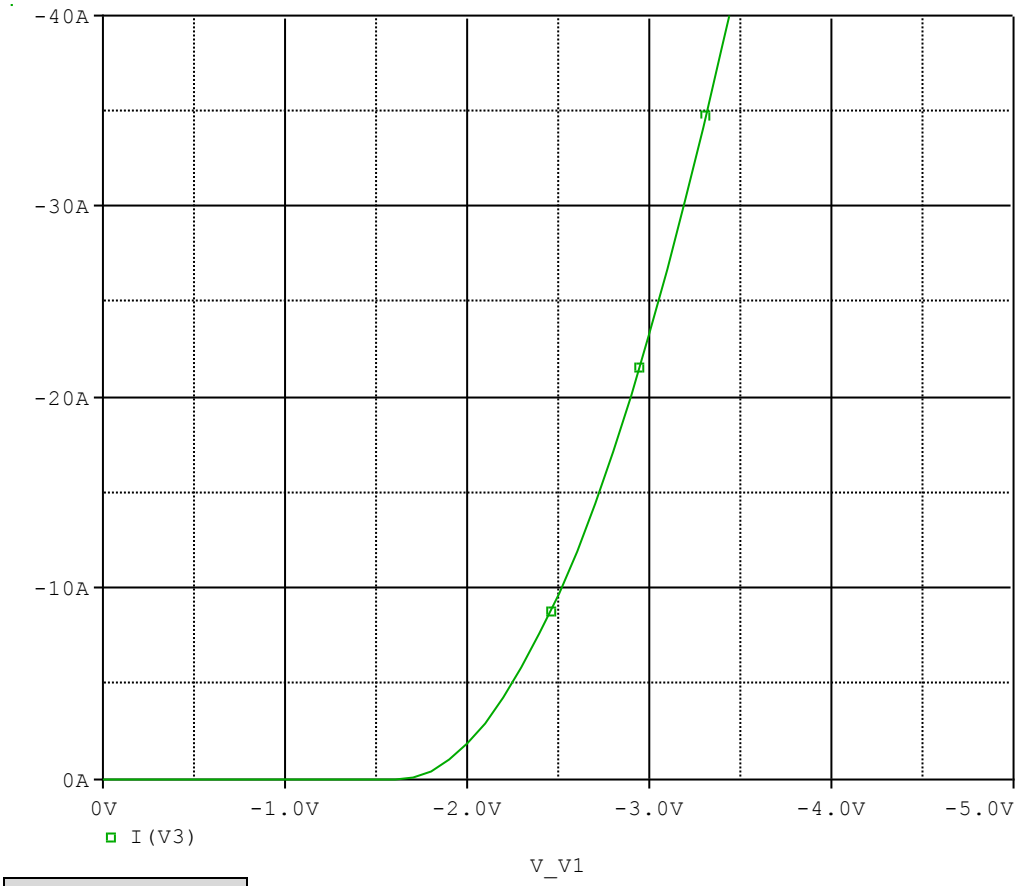


Comparison table

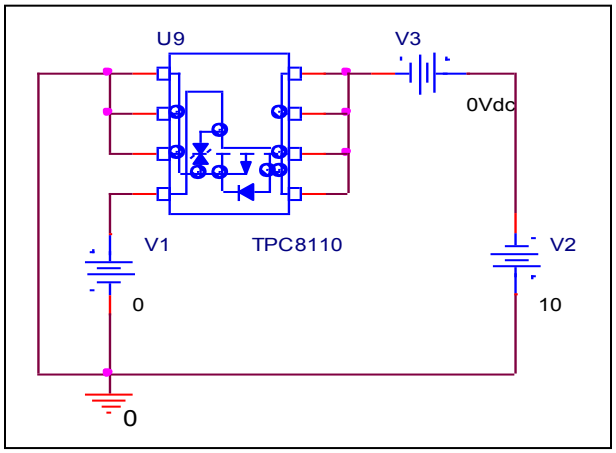
- Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	2.000	2.000	0.000
0.2	3.300	3.333	1.000
0.5	6.200	6.250	0.806
1	7.700	7.692	-0.104
2	11.00	11.111	1.009
5	15.500	15.625	0.806
10	22.000	22.222	1.009
20	31.500	31.746	0.781

Vgs-Id Characteristic

Circuit Simulation result

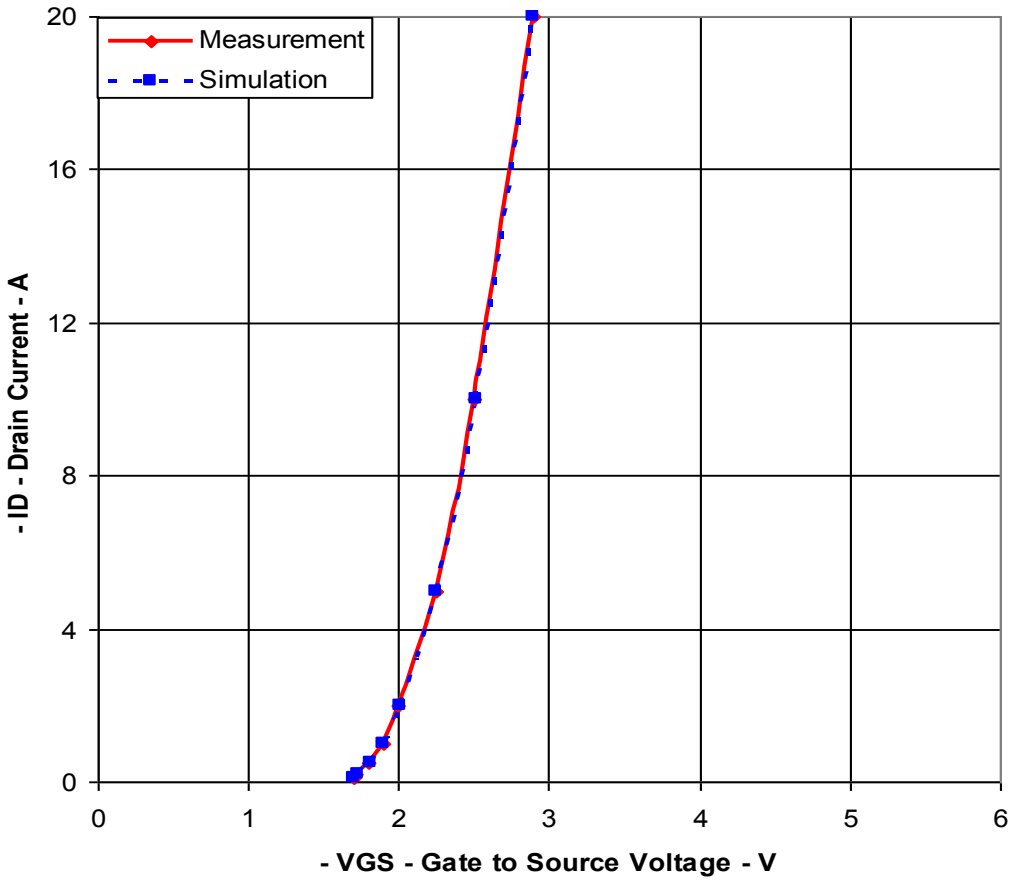


Evaluation circuit



Comparison Graph

Circuit Simulation Result

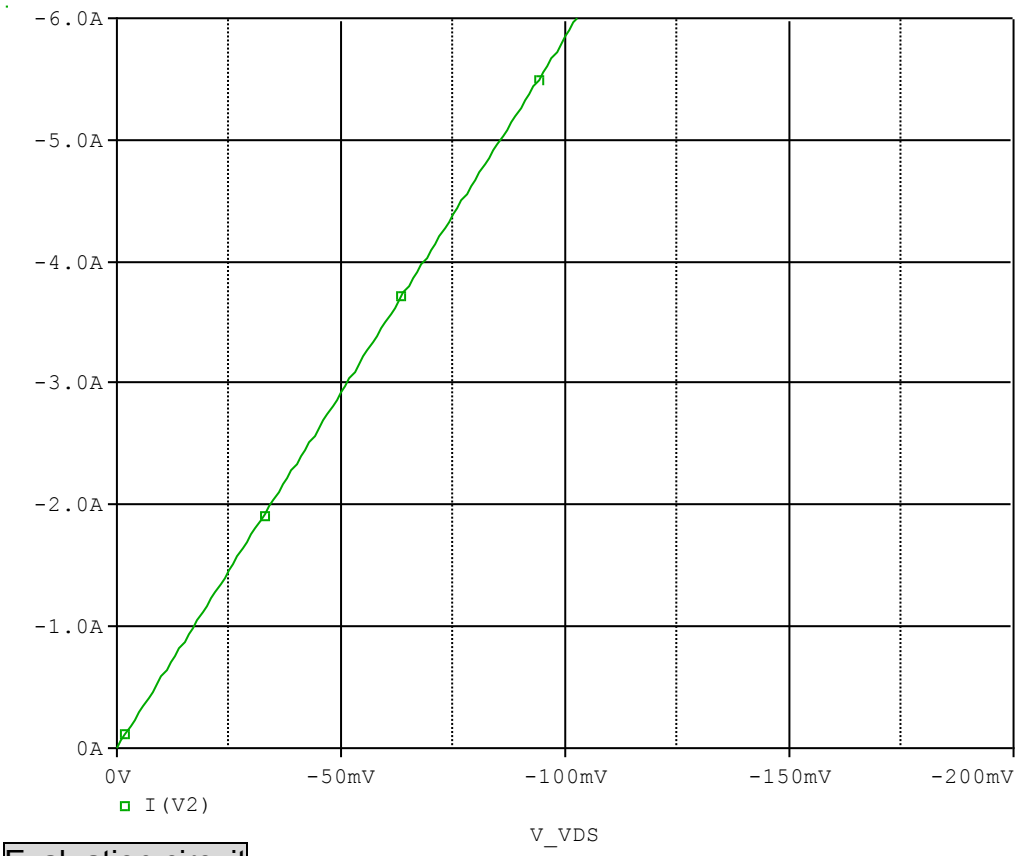


Simulation Result

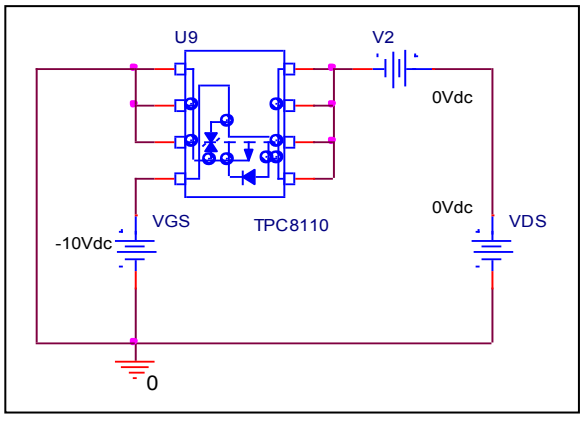
- I_D(A)	- V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.1	1.700	1.696	-0.235
0.2	1.720	1.727	0.407
0.5	1.800	1.807	0.389
1	1.900	1.892	-0.421
2	2.000	2.009	0.450
5	2.250	2.244	-0.267
10	2.500	2.512	0.480
20	2.900	2.895	-0.172

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

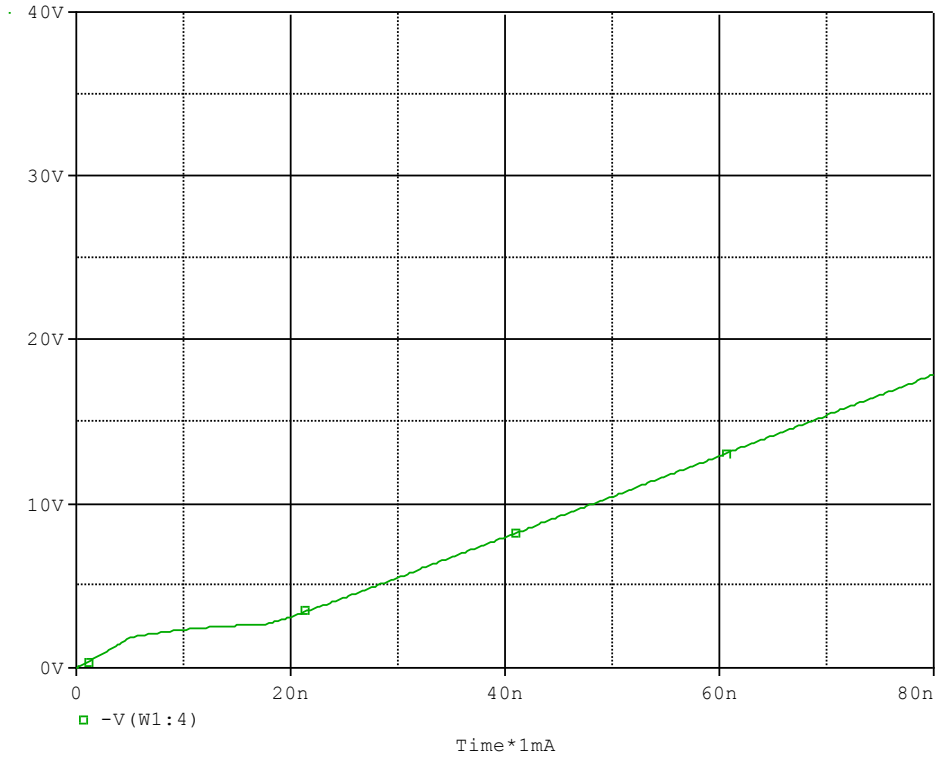


Simulation Result

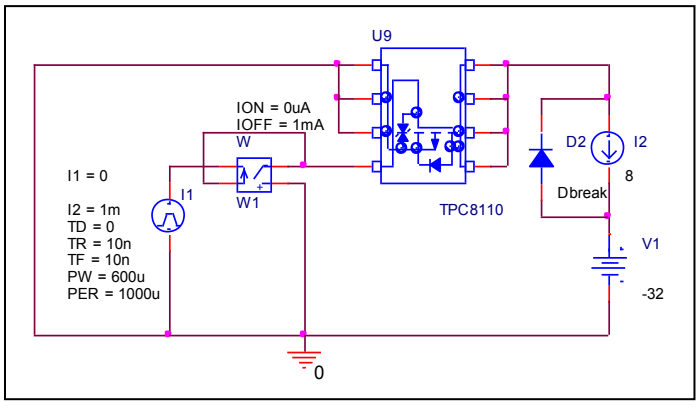
I_D=-4A, V_{GS}=-10V	Measurement		Simulation		Error (%)
R_{DS} (on)	17.000	mΩ	17.107	mΩ	0.629

Gate Charge Characteristic

Circuit Simulation result



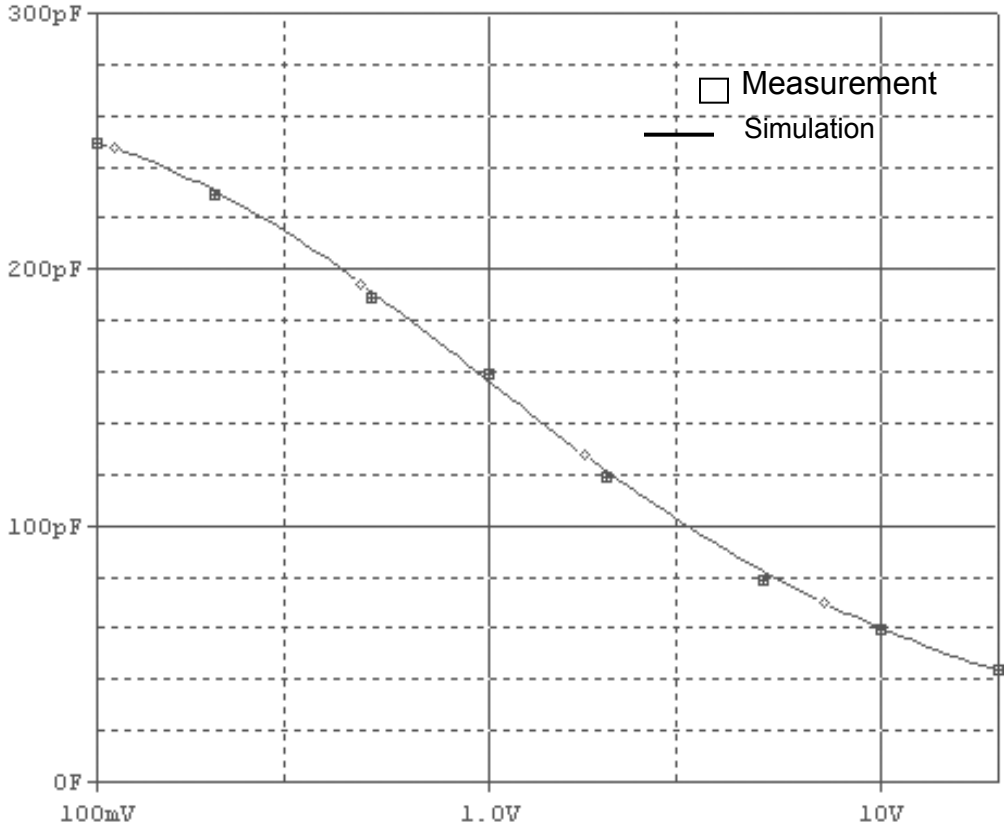
Evaluation circuit



Simulation Result

V_{DD}=-32V,I_D=-8A ,V_{GS}=-10V	Measurement	Simulation	Error (%)
Qgs(nC)	5.500	5.546	0.836
Qgd(nC)	12.000	12.000	0.000
Qg	48.000	48.207	0.431

Capacitance Characteristic

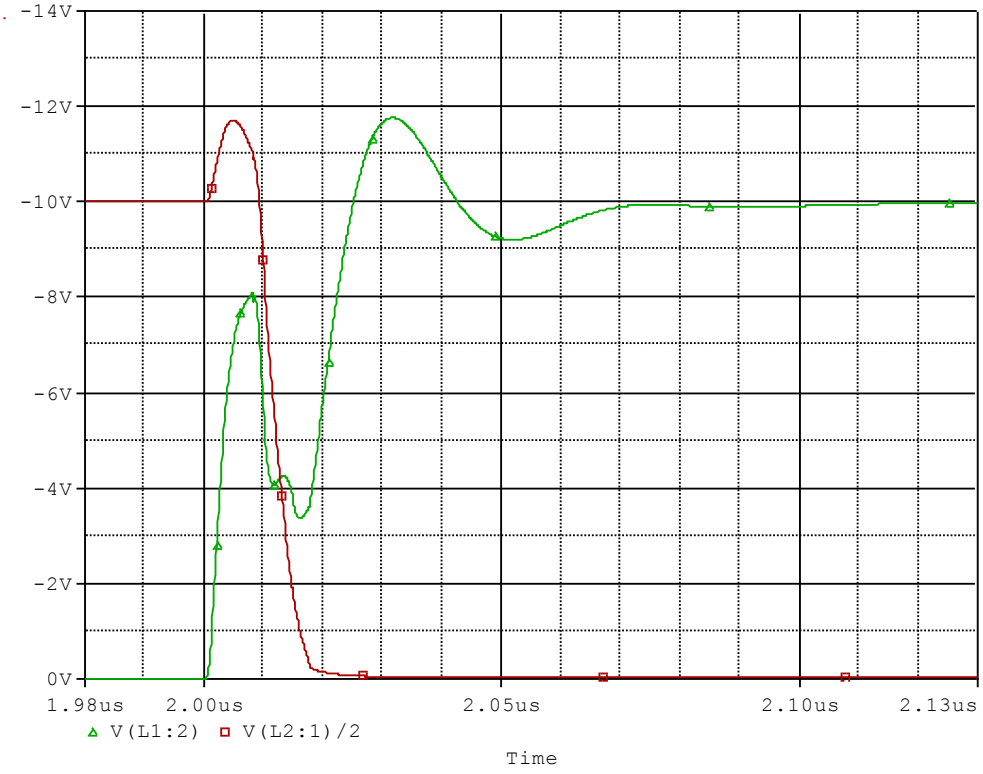


Simulation Result

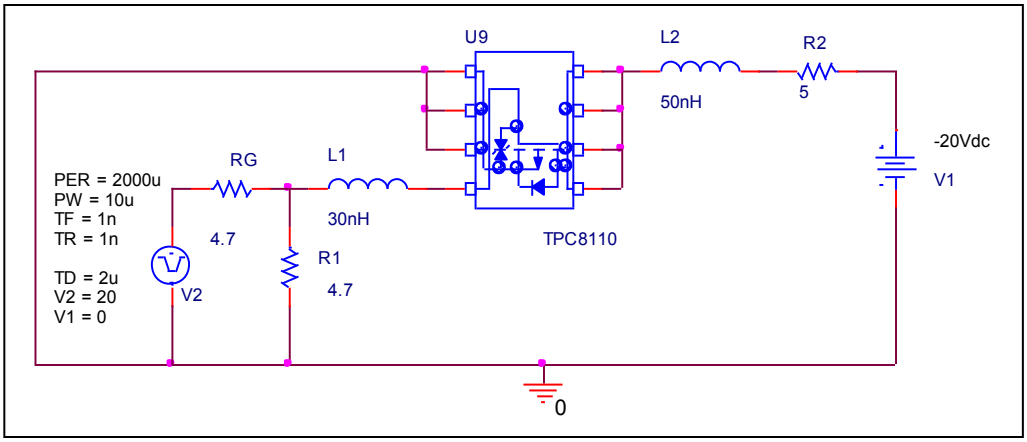
- V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	250.000	250.000	0.000
0.2	227.000	230.000	1.322
0.5	188.000	190.000	1.064
1	163.000	160.000	-1.840
2	118.000	120.000	1.695
5	77.000	80.000	3.896
10	60.000	60.000	0.000
20	45.000	45.000	0.000

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

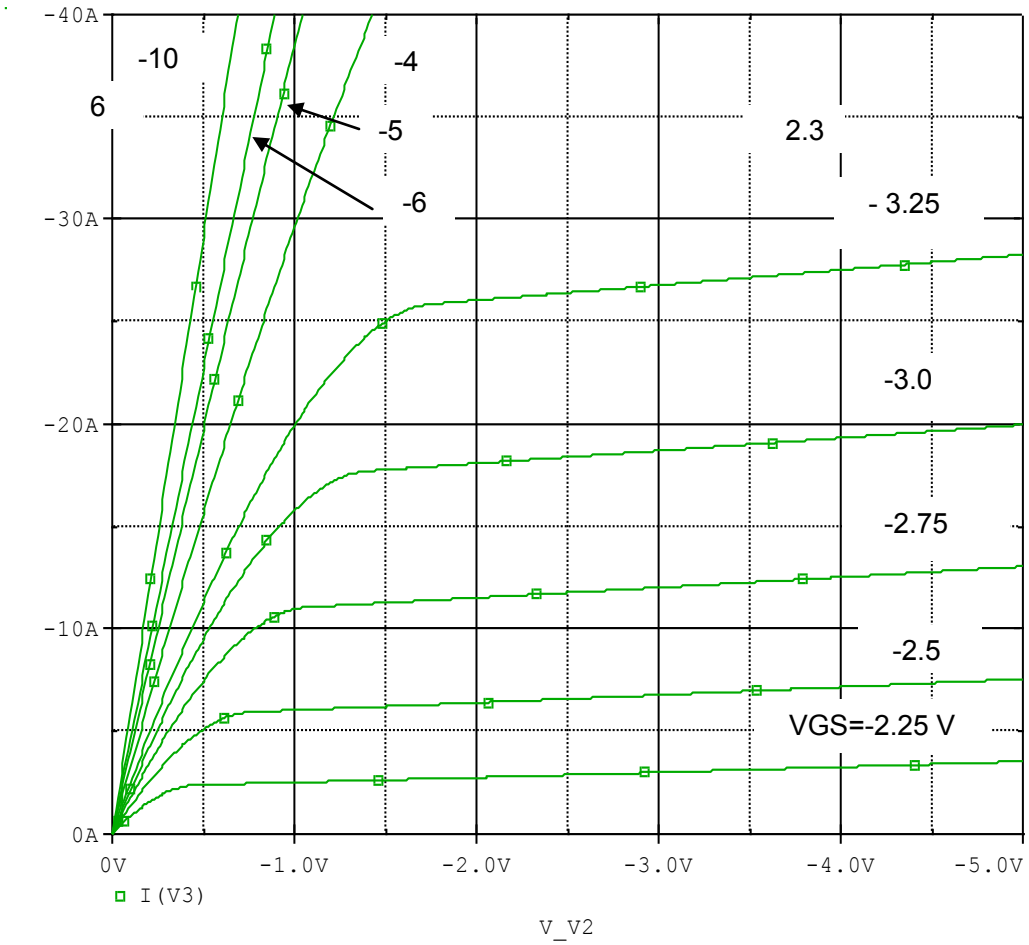


Simulation Result

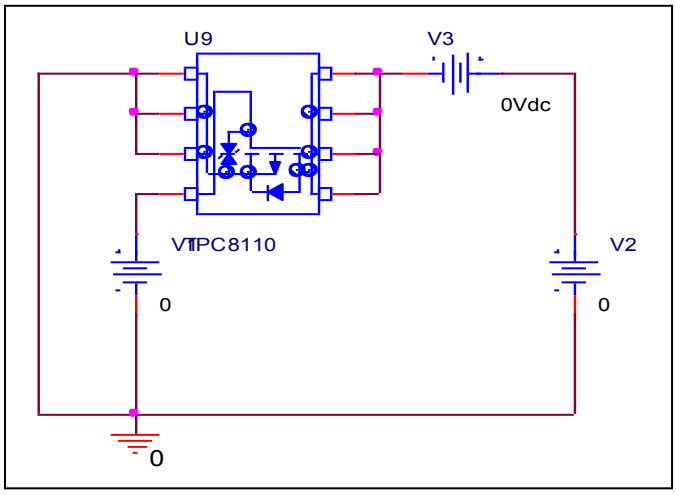
I_D=-4 A, V_{DD}=-20V V_{GS}=0/-10V	Measurement	Simulation	Error(%)
Ton(ns)	15.000	14.846	-1.027

Output Characteristic

Circuit Simulation result

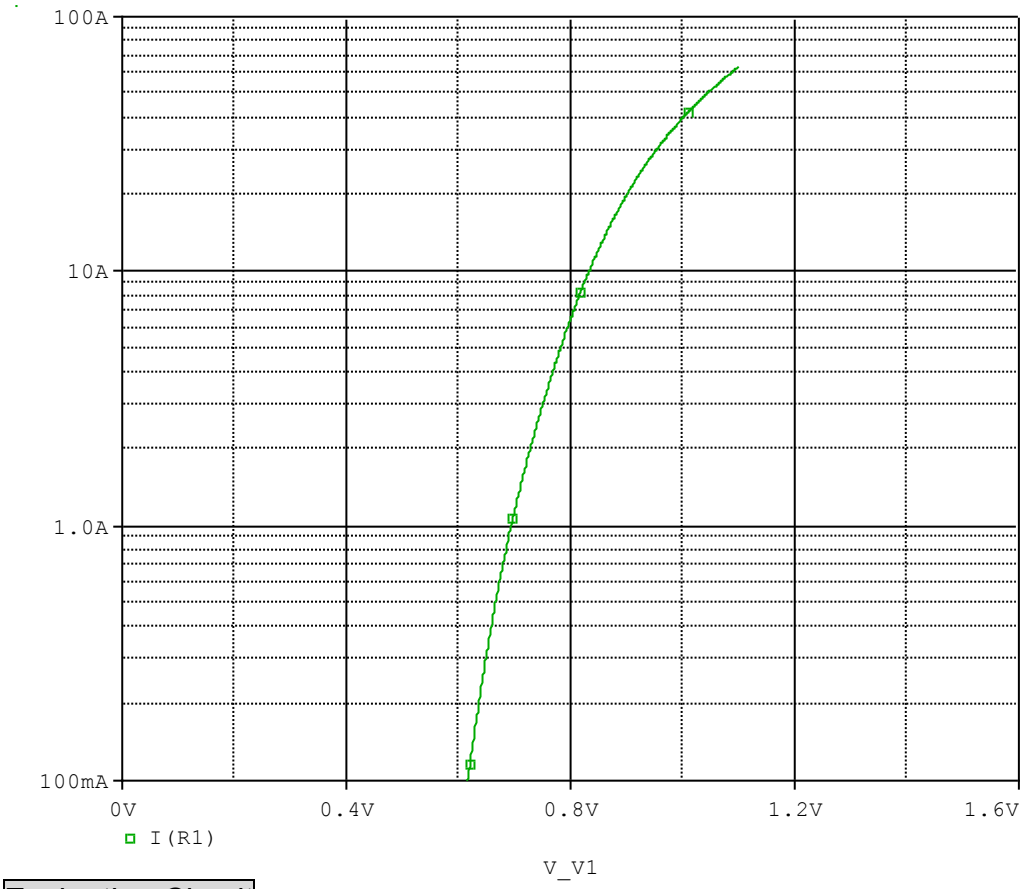


Evaluation circuit

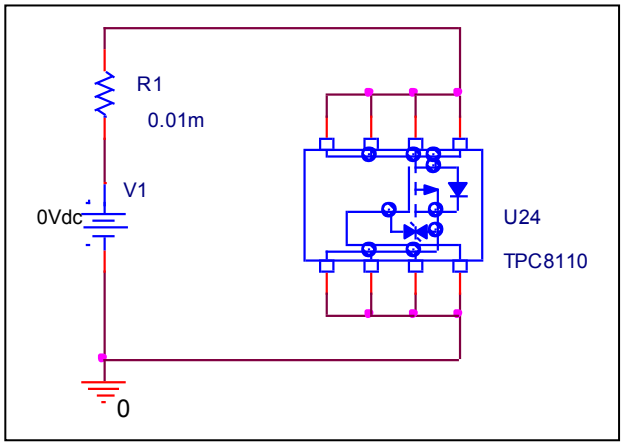


Forward Current Characteristic

Circuit Simulation Result

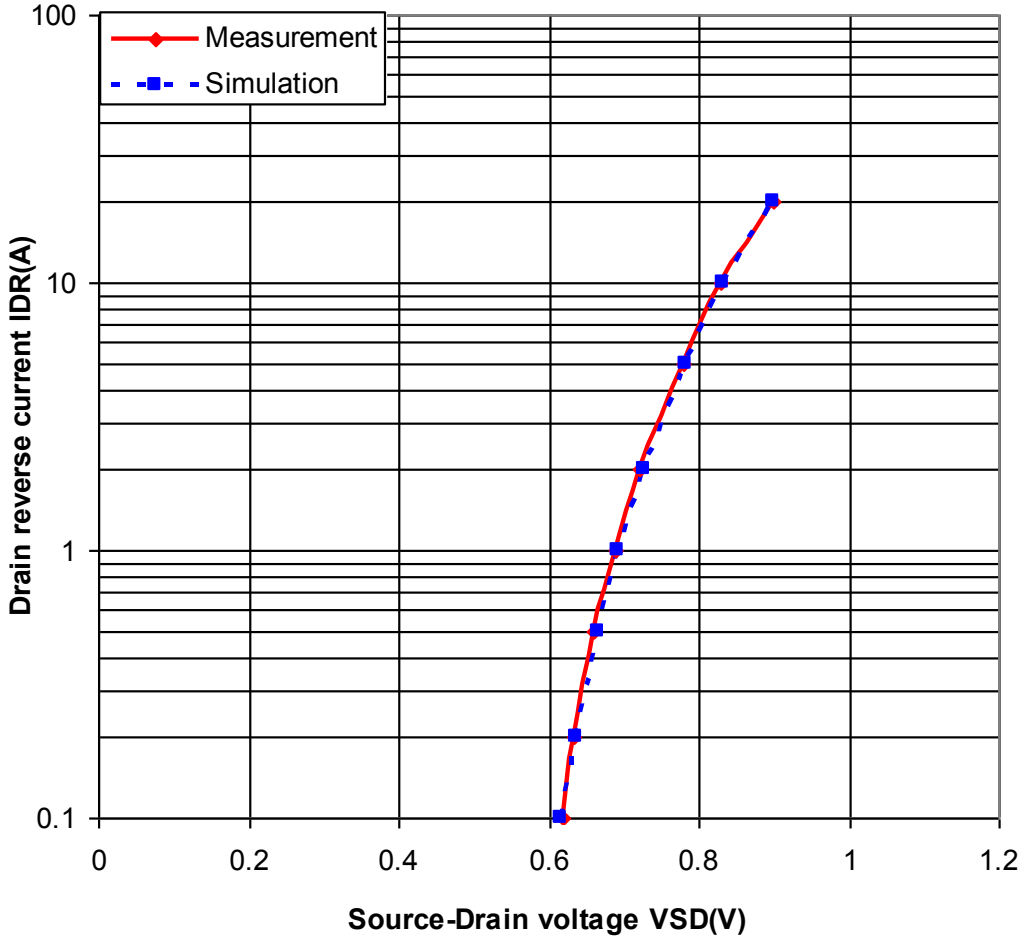


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

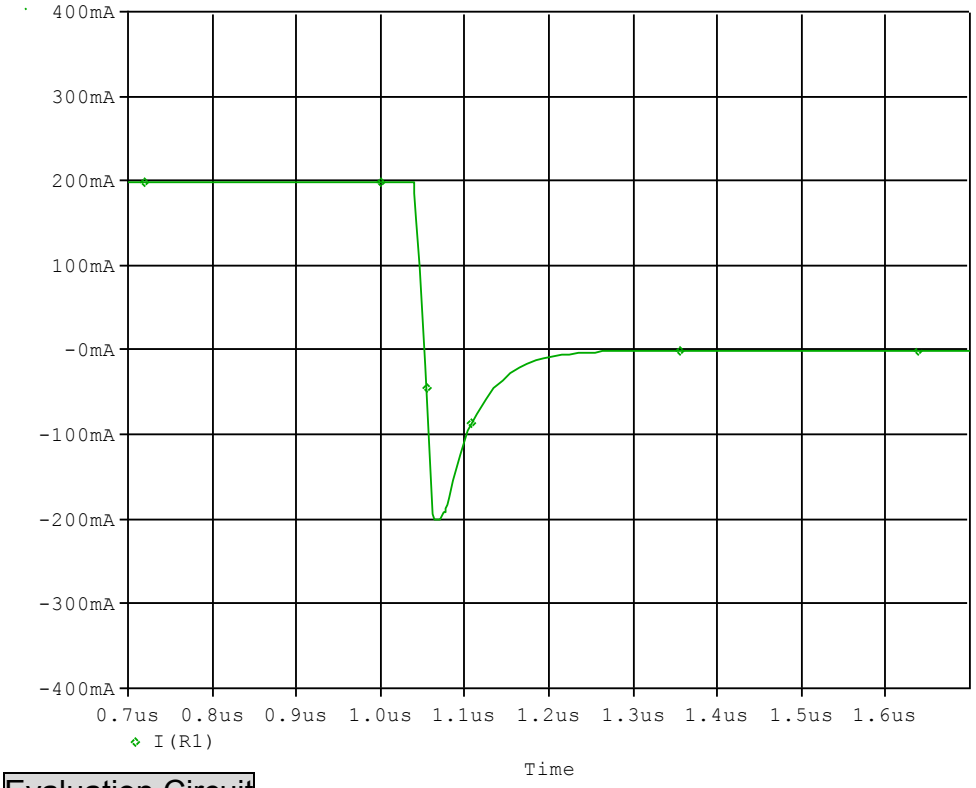


Simulation Result

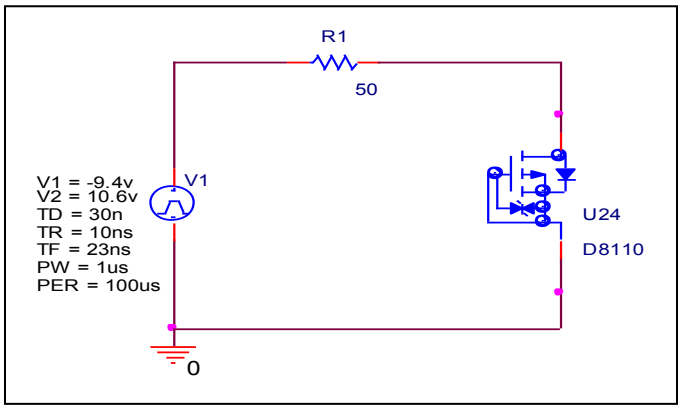
IDR(A)	VSD(V)		%Error
	Measuremen	Simulation	
0.1	0.620	0.616	-0.65
0.2	0.635	0.636	0.16
0.5	0.660	0.665	0.76
1	0.690	0.693	0.43
2	0.720	0.727	0.97
5	0.780	0.782	0.26
10	0.830	0.832	0.24
20	0.900	0.900	0.00

Reverse Recovery Characteristic

Circuit Simulation Result



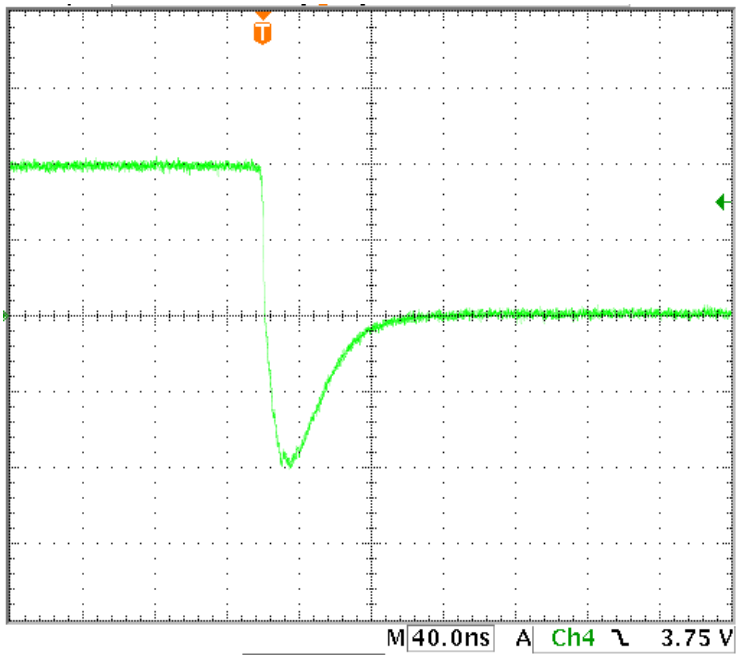
Evaluation Circuit



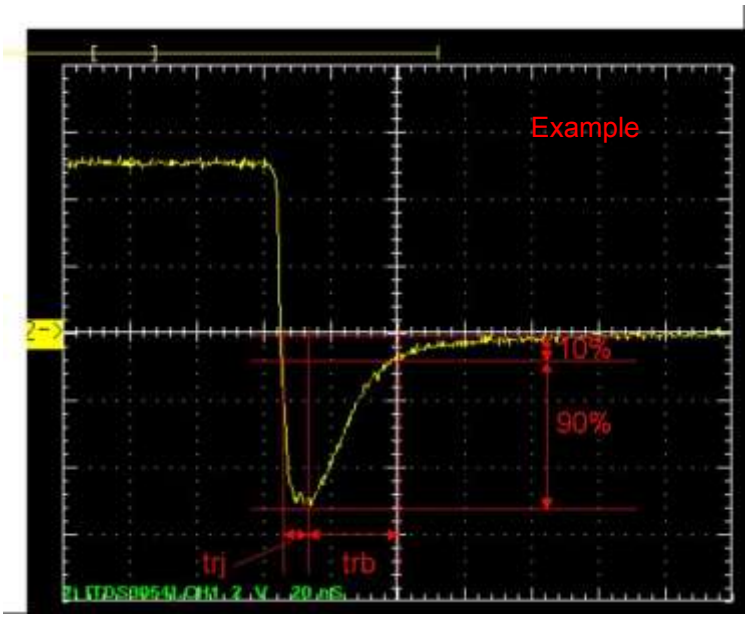
Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(ns)	19.000	19.056	0.295
Trb(ns)	96.000	96.008	0.008
Trr(ns)	115.000	115.064	0.056

Reverse Recovery Characteristic Reference



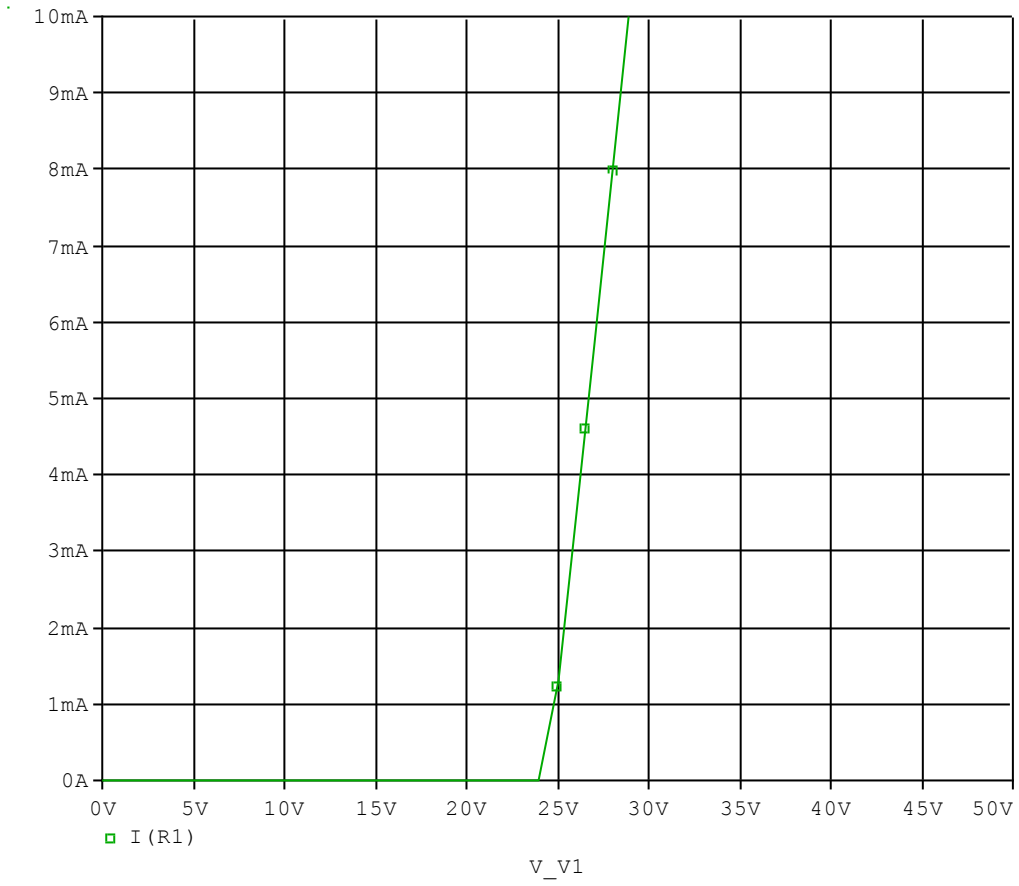
Trj=19(ns)
Trb=96(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



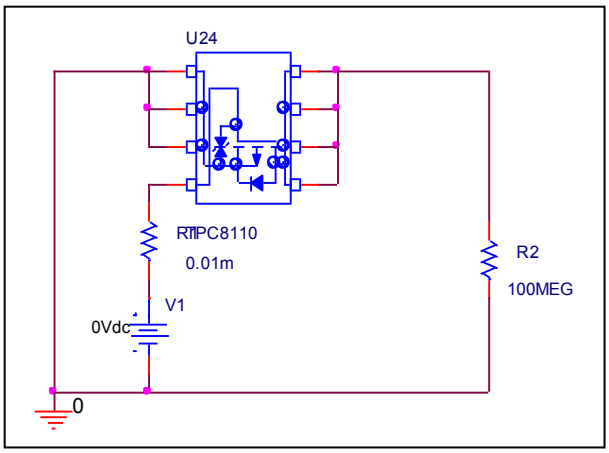
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference