Device Modeling Report

COMPONENTS: MOSFET (Professional Model)
PART NUMBER: 2SK3546
MANUFACTURER: Panasonic
Body Diode (Professional) / ESD Protection Diode

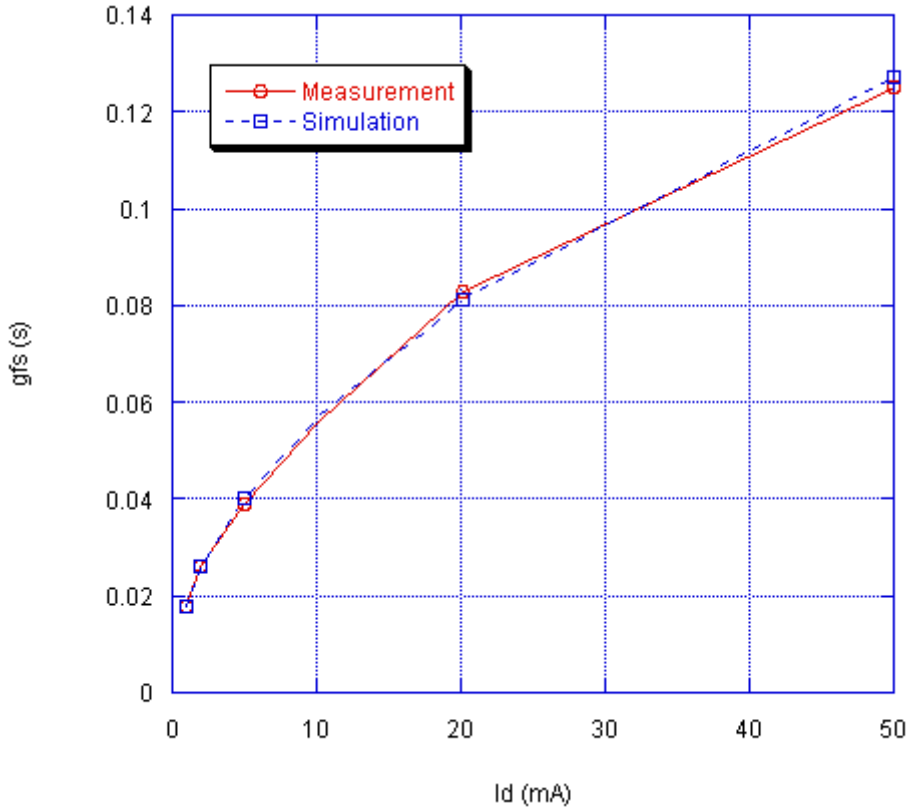
Bee Technologies Inc.

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

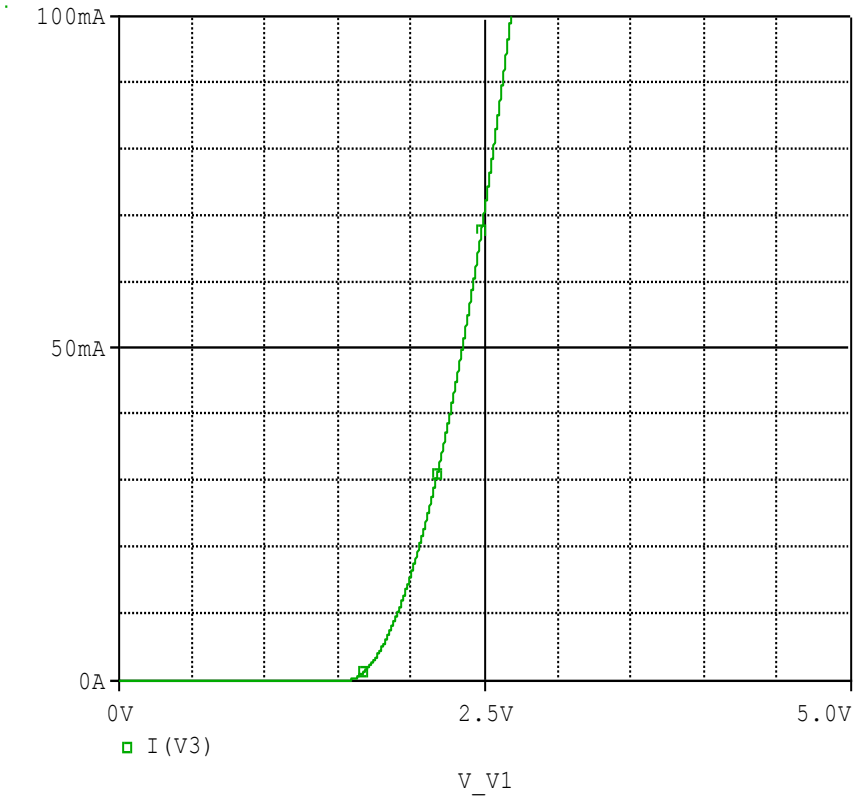


Comparison table

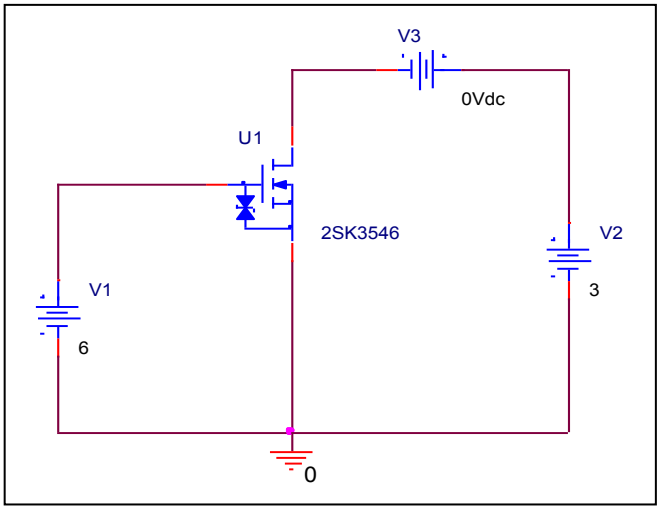
Id(mA)	gfs (s)		Error (%)
	Measurement	Simulation	
1.037	0.018	0.018	1.011
1.990	0.026	0.026	-2.320
5.010	0.039	0.040	4.283
10.080	0.056	0.057	2.041
20.200	0.083	0.081	-2.248
50.000	0.125	0.127	1.781

Vgs-Id Characteristic

Circuit Simulation result

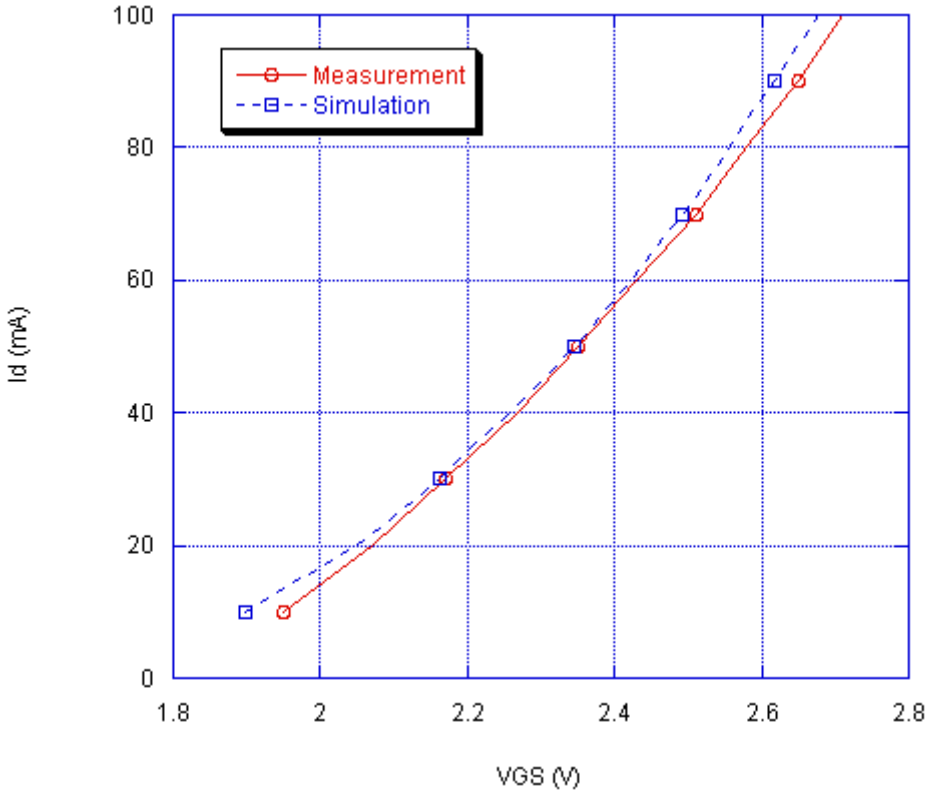


Evaluation circuit



Comparison Graph

Circuit Simulation Result

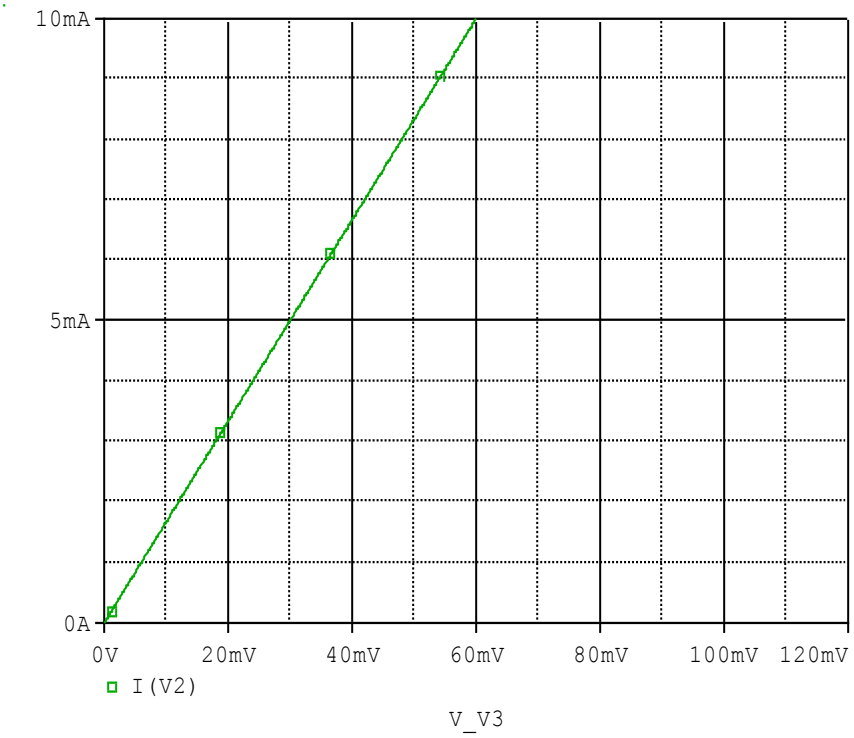


Simulation Result

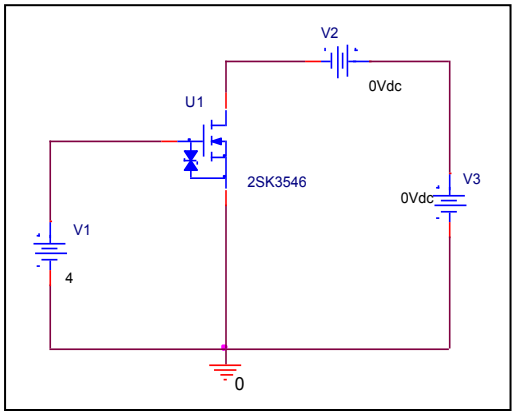
I_D(mA)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
10.000	1.950	1.899	-2.615
20.000	2.070	2.048	-1.068
30.000	2.170	2.162	-0.359
40.000	2.270	2.259	-0.507
50.000	2.350	2.344	-0.277
60.000	2.430	2.420	-0.399
70.000	2.512	2.491	-0.836
80.000	2.580	2.557	-0.903
90.000	2.650	2.618	-1.192
100.000	2.710	2.677	-1.221

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

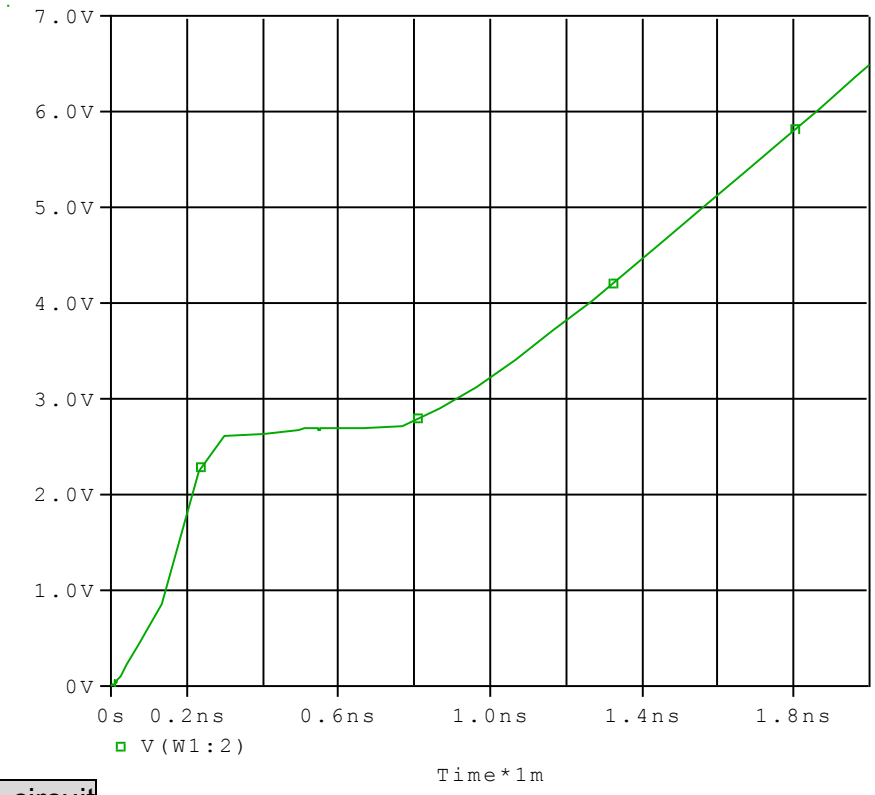


Simulation Result

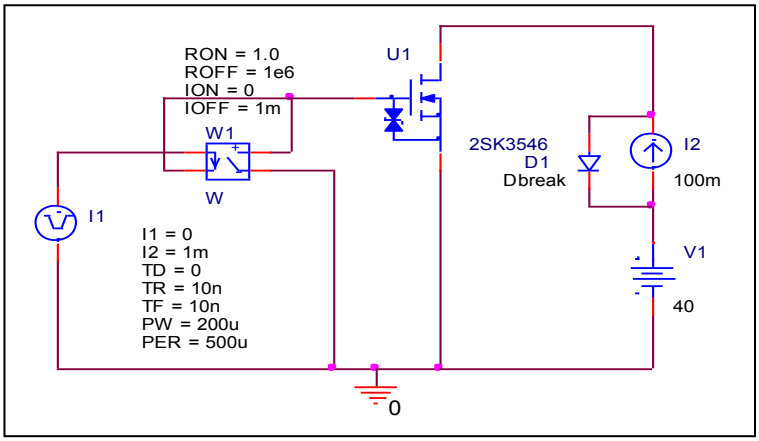
I_D=10mA, V_{GS}=4.0V	Measurement		Simulation		Error (%)
R_{DS} (on)	6.000	Ω	6.000	Ω	0.000

Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit

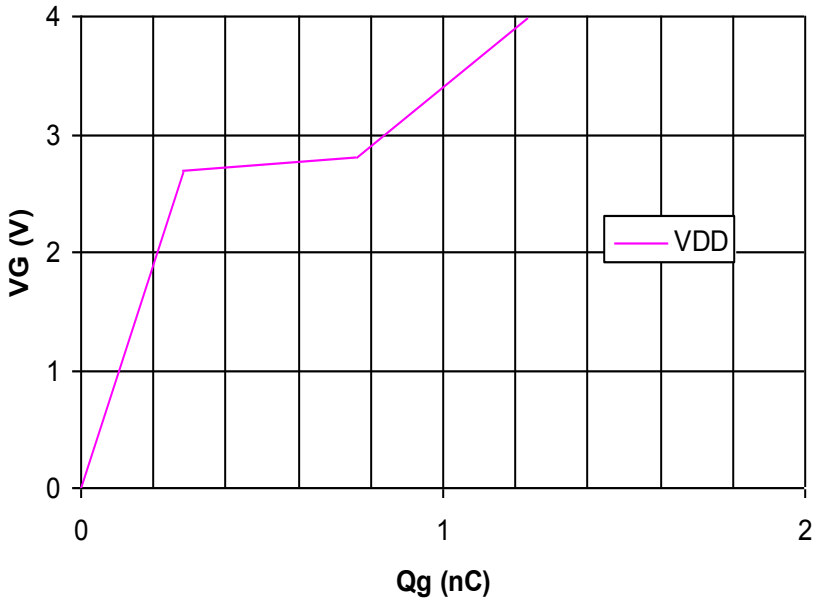


Simulation Result

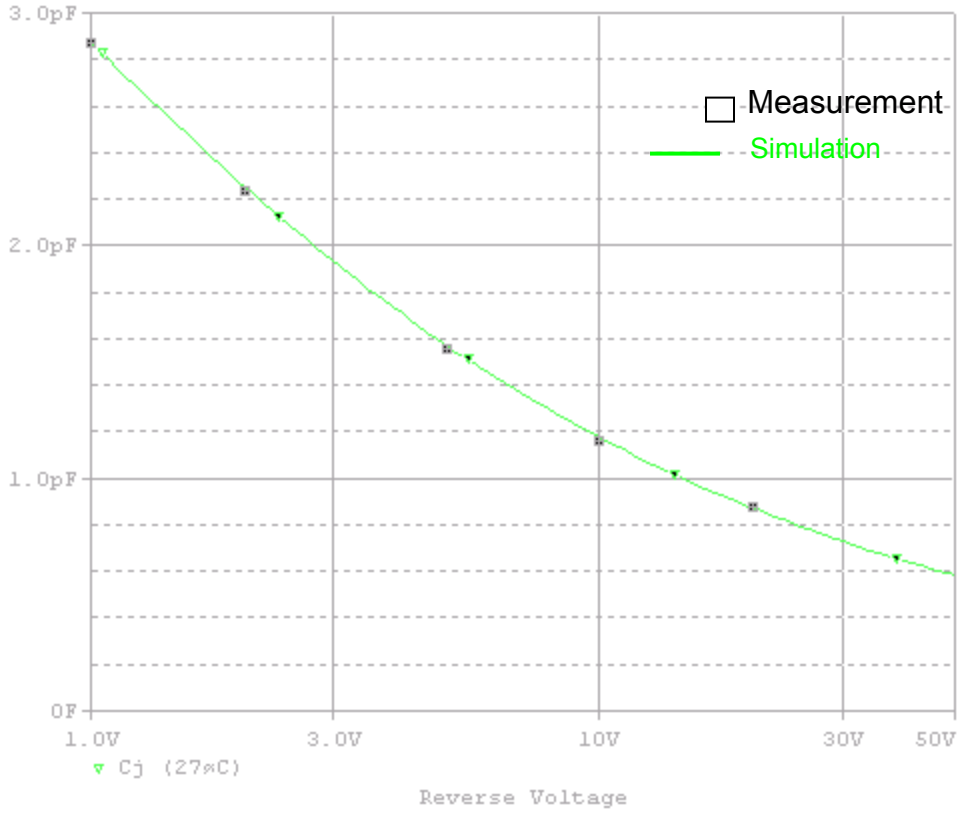
V_{DD}=40V,I_D=0.1A ,V_G=4.0V	Measurement		Simulation		Error (%)
Qgs	0.280	nC	0.273	nC	-2.436
Qgd	0.480	nC	0.488	nC	1.595
Qg	1.240	nC	1.248	nC	0.653

Gate Charge Characteristic

Reference



Capacitance Characteristic

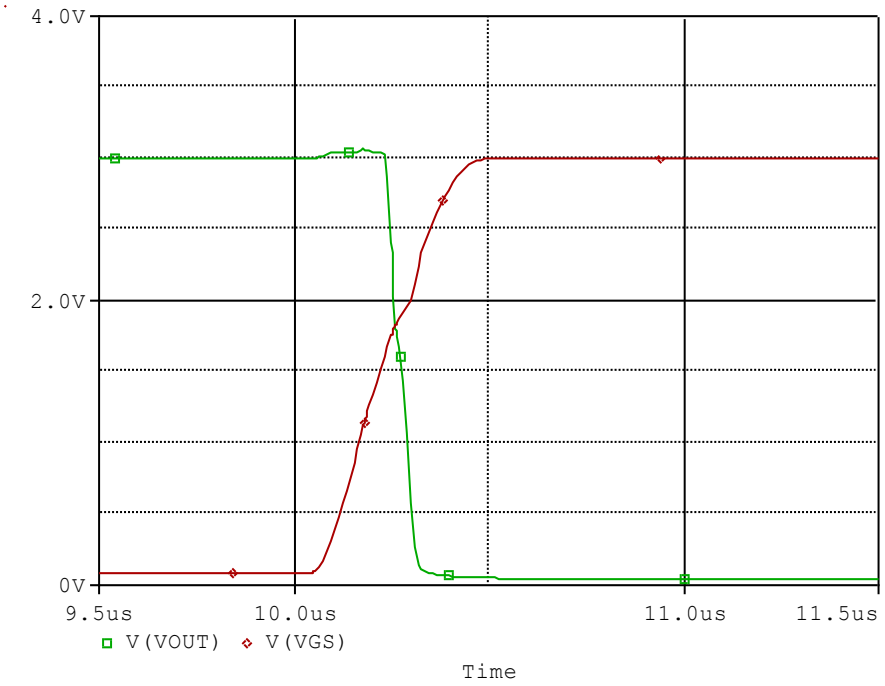


Simulation Result

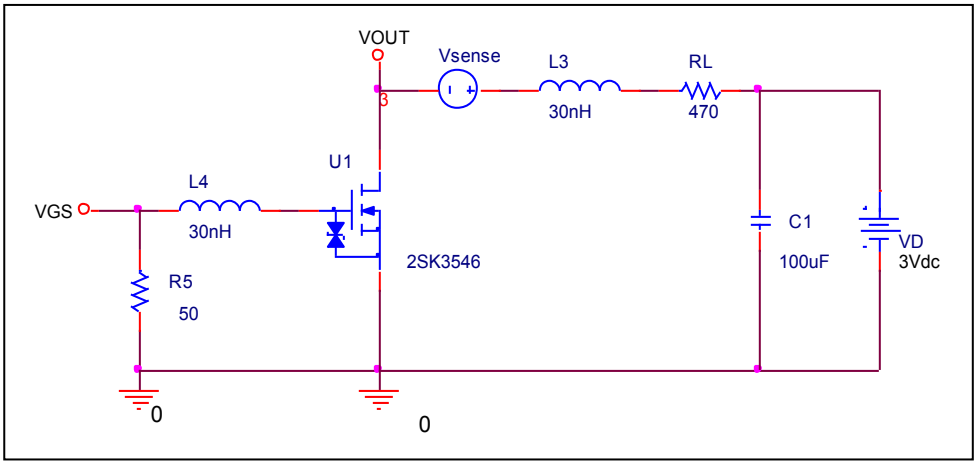
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
1.000	2.879	2.870	-0.316
2.000	2.245	2.250	0.245
5.000	1.565	1.570	0.352
10.000	1.173	1.175	0.205
20.000	0.885	0.870	-1.710

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

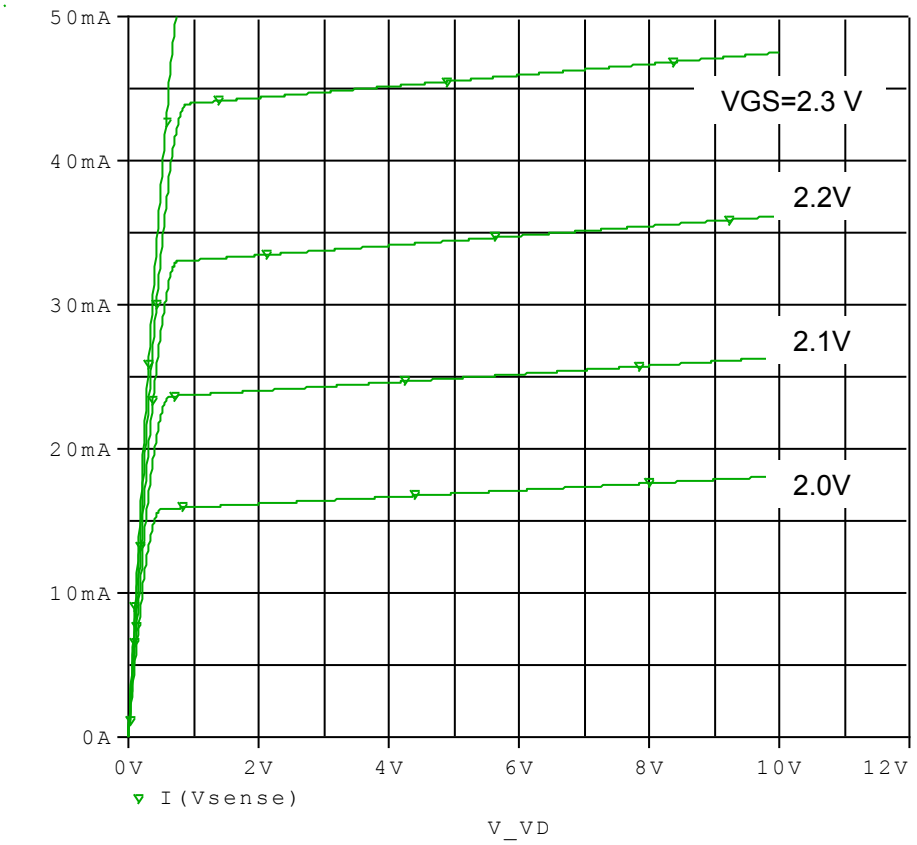


Simulation Result

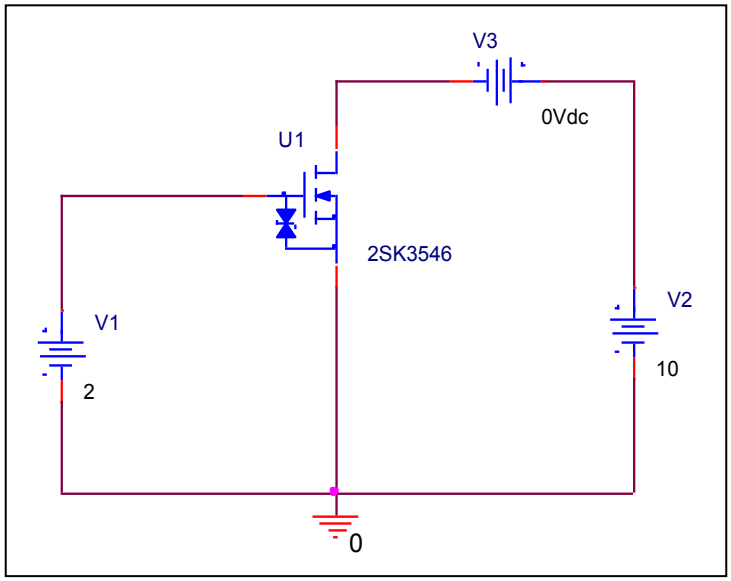
R_L=470, V_{DD}=3V V_{GS}=0V~3V	Measurement		Simulation		Error(%)
ton	200.000	ns	204.201	ns	2.101

Output Characteristic

Circuit Simulation result

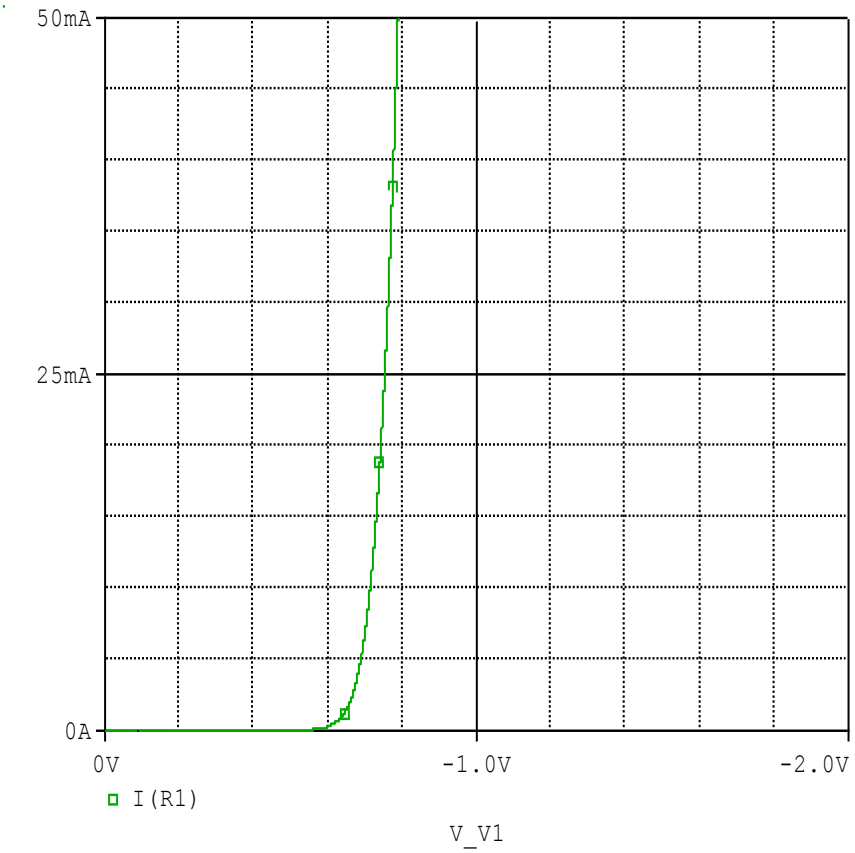


Evaluation circuit

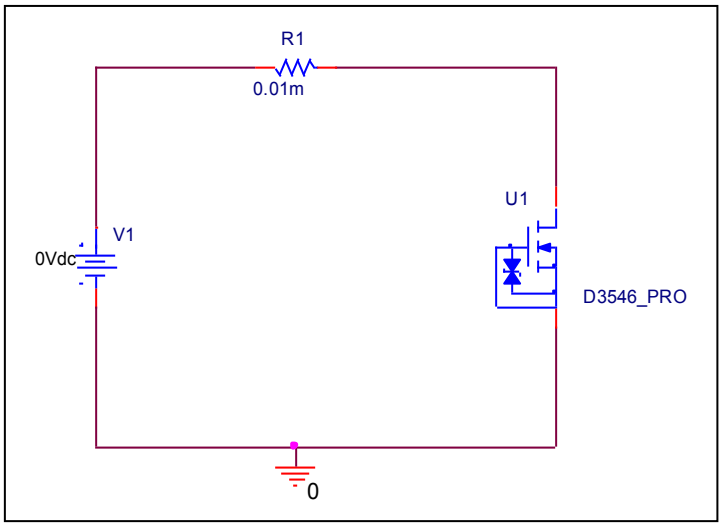


Reverse Drain Current Characteristic

Circuit Simulation Result

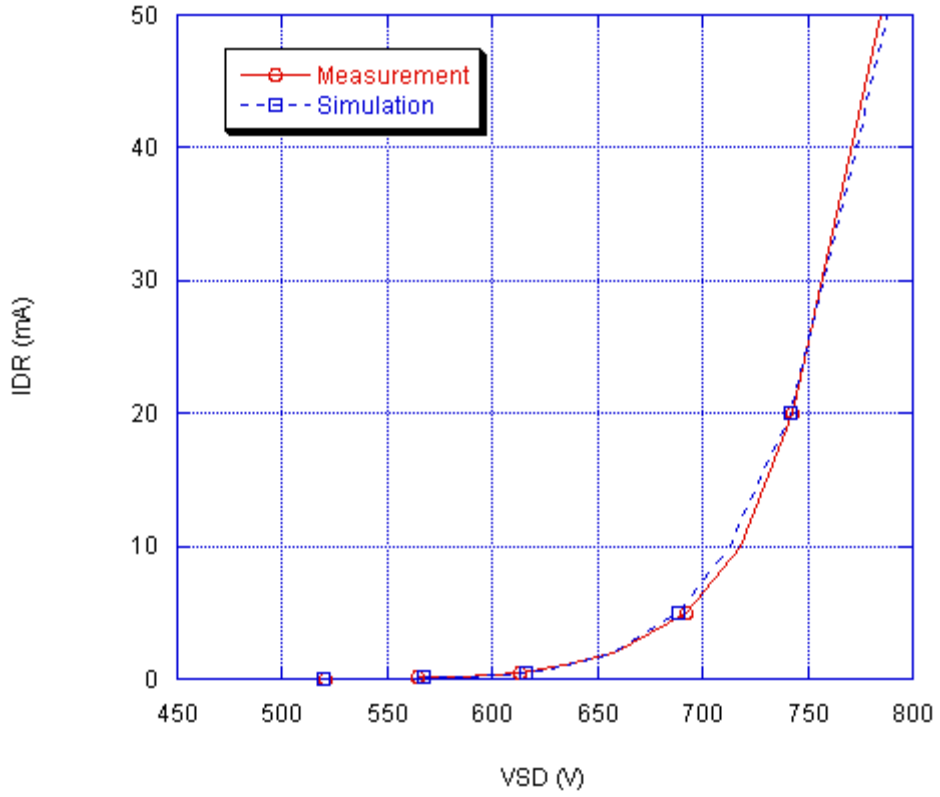


Evaluation Circuit



Comparison Graph

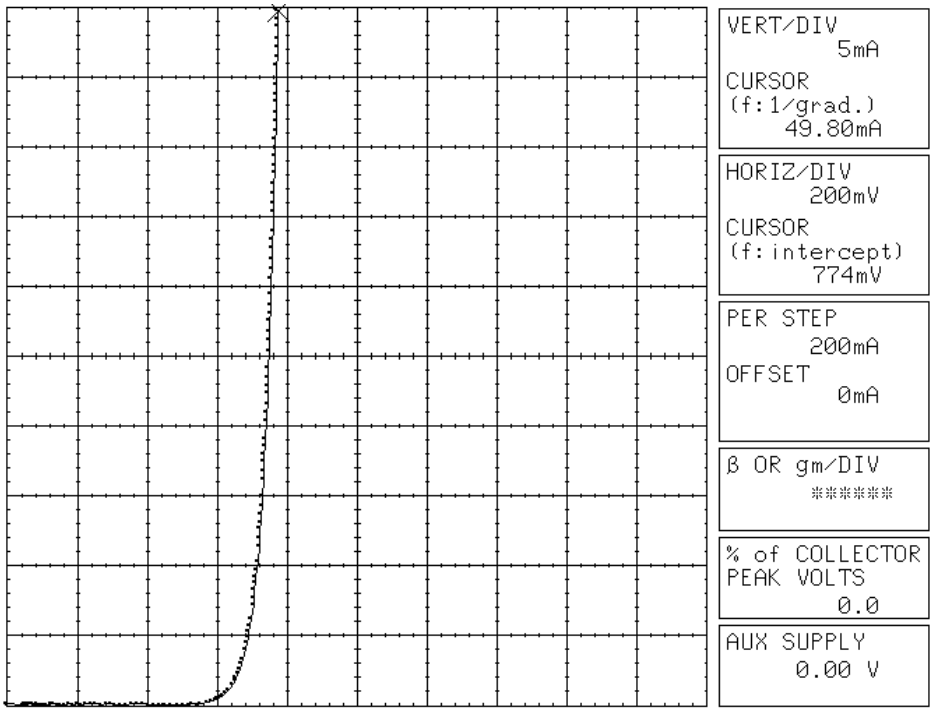
Circuit Simulation Result



Simulation Result

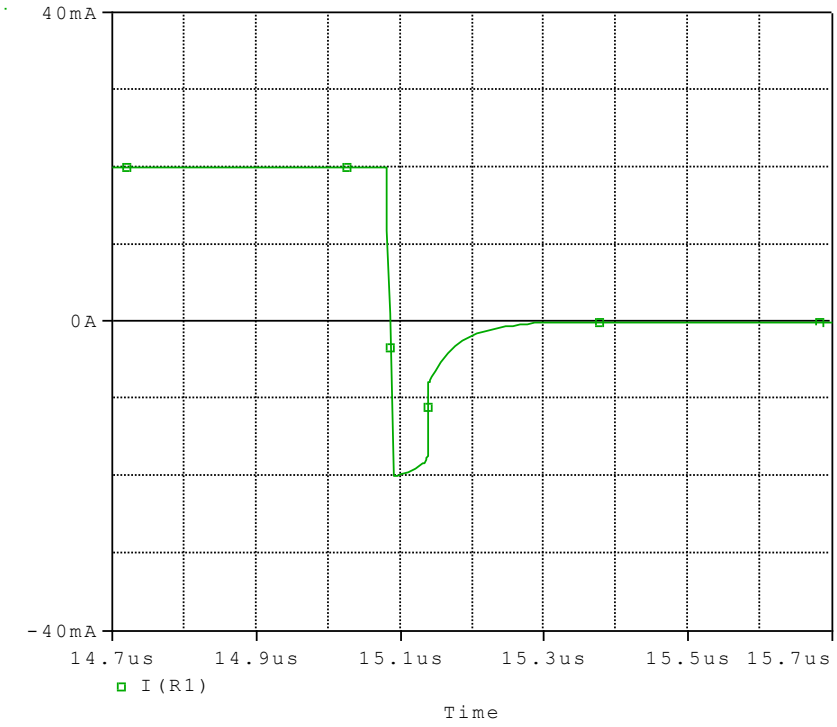
IDR (mA)	VSD (V)		%Error
	Measurement	Simulation	
0.010	0.502	0.499	-0.598
0.020	0.521	0.519	-0.384
0.050	0.547	0.547	0.000
0.100	0.564	0.567	0.532
0.200	0.584	0.588	0.685
0.500	0.613	0.616	0.489
1.000	0.634	0.637	0.473
2.000	0.658	0.658	0.000
5.000	0.692	0.688	-0.578
10.000	0.718	0.713	-0.696
20.000	0.743	0.742	-0.135
50.000	0.785	0.788	0.382

Reverse Drain Current Characteristics Reference

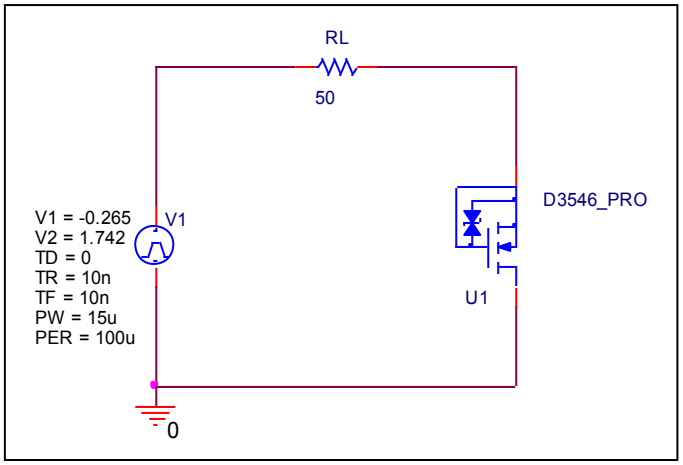


Reverse Recovery Characteristic

Circuit Simulation Result



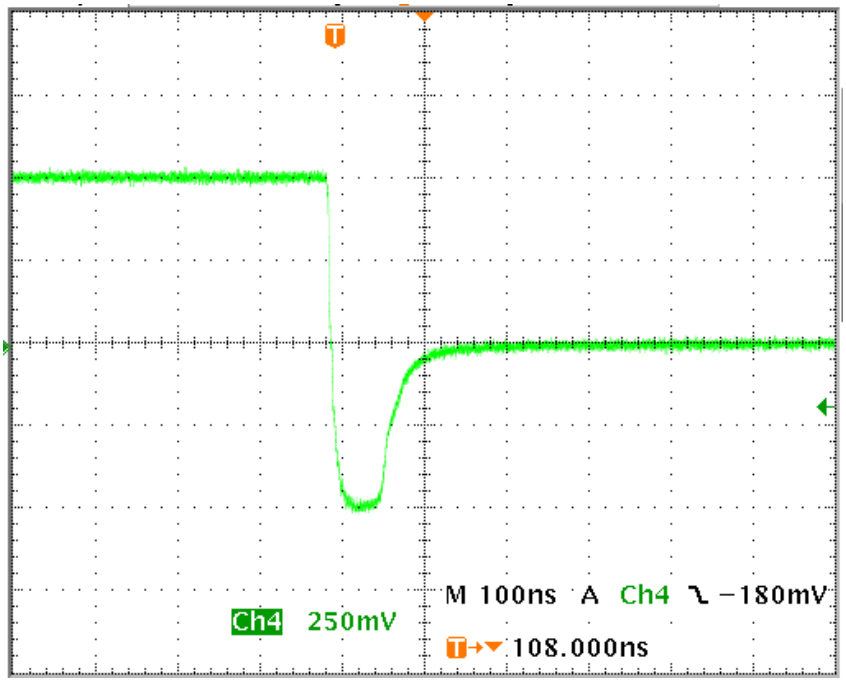
Evaluation Circuit



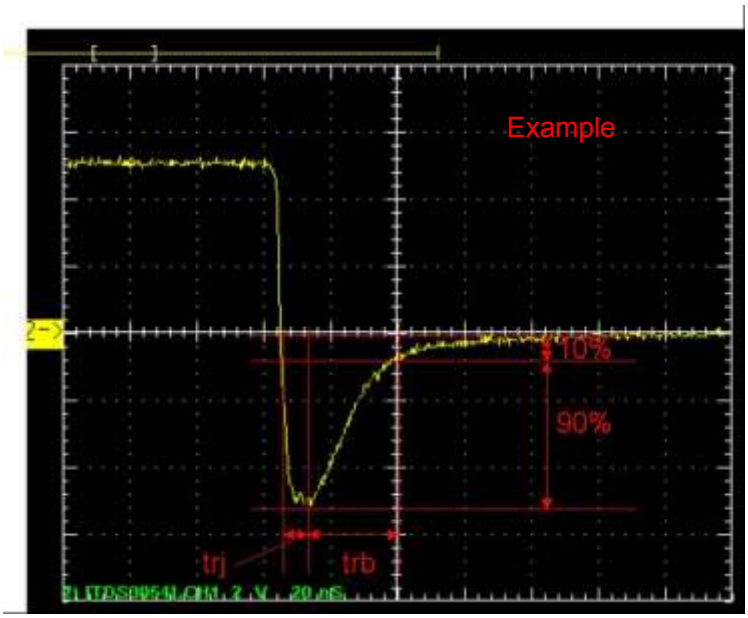
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	**38.000**	**ns**	**37.994**	**ns**	**-0.016**
trb	**74.000**	**ns**	**73.358**	**ns**	**-0.868**
trr	**112.000**	**ns**	**111.352**	**ns**	**-0.579**

Reverse Recovery Characteristic Reference



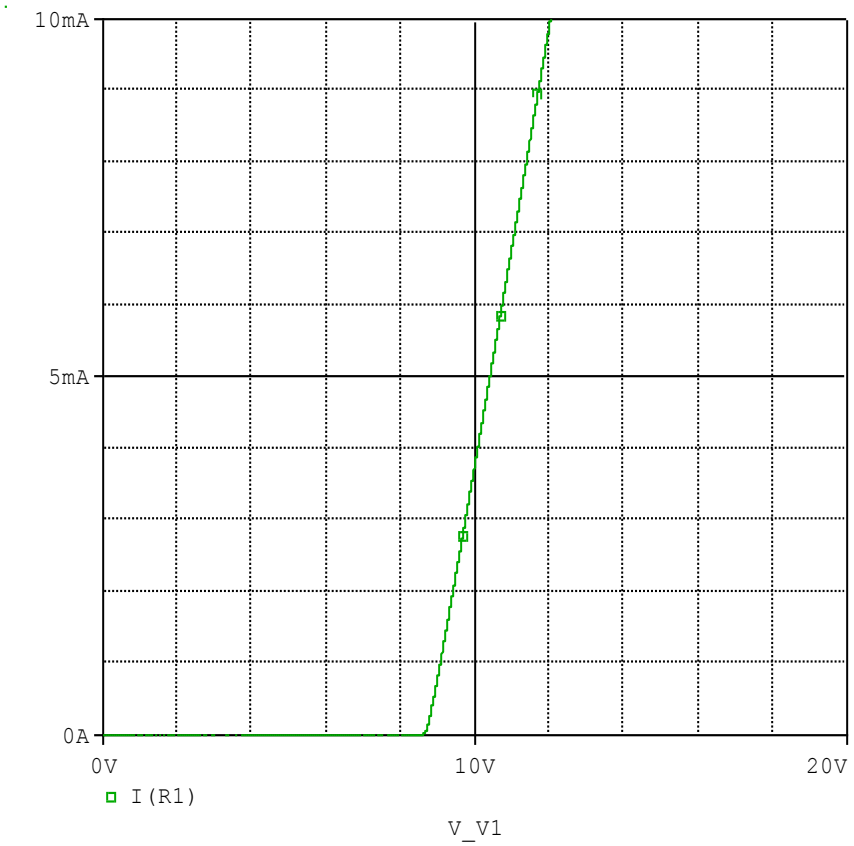
Trj=38(ns)
Trb=74(ns)
Conditions:Ifwd=Irev=0.02(A),Rl=50



Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit