Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SK3869
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

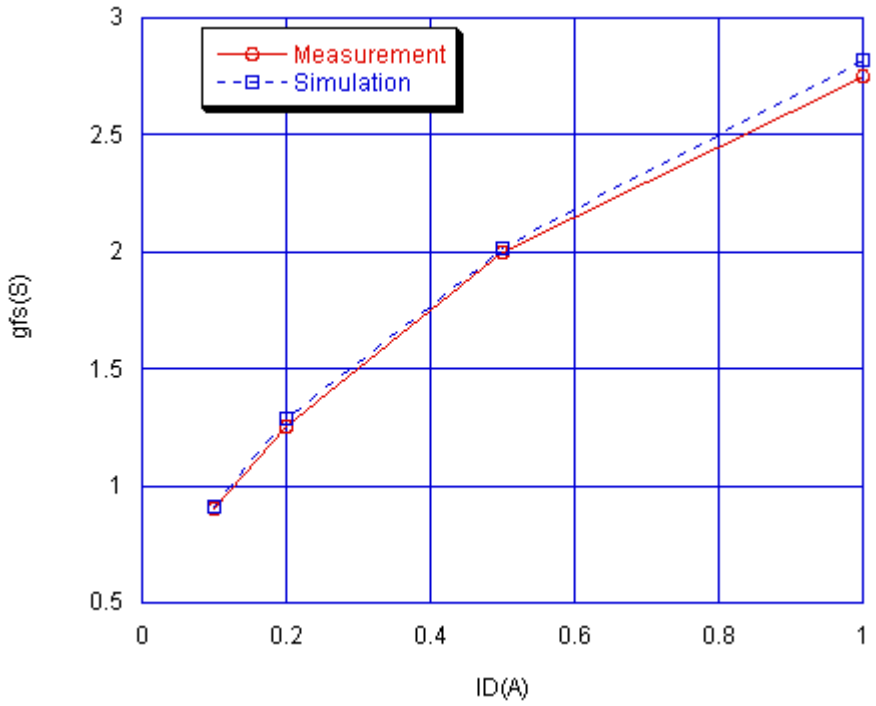
Bee Technologies Inc.

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

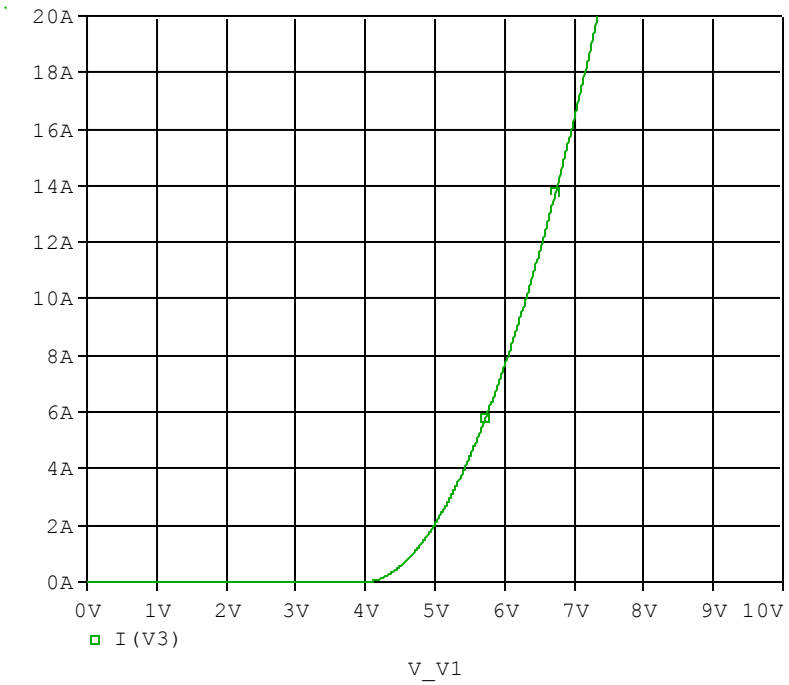


Comparison table

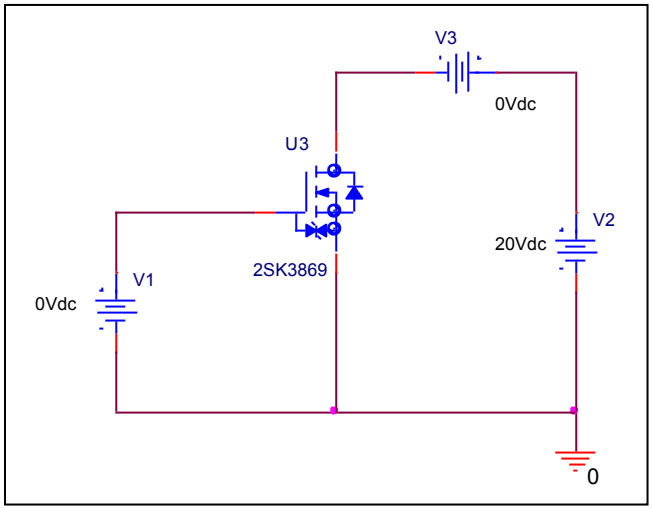
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.100	0.900	0.911	1.222
0.200	1.250	1.285	2.816
0.500	2.000	2.014	0.690
1.000	2.750	2.824	2.695

Vgs-Id Characteristic

Circuit Simulation result

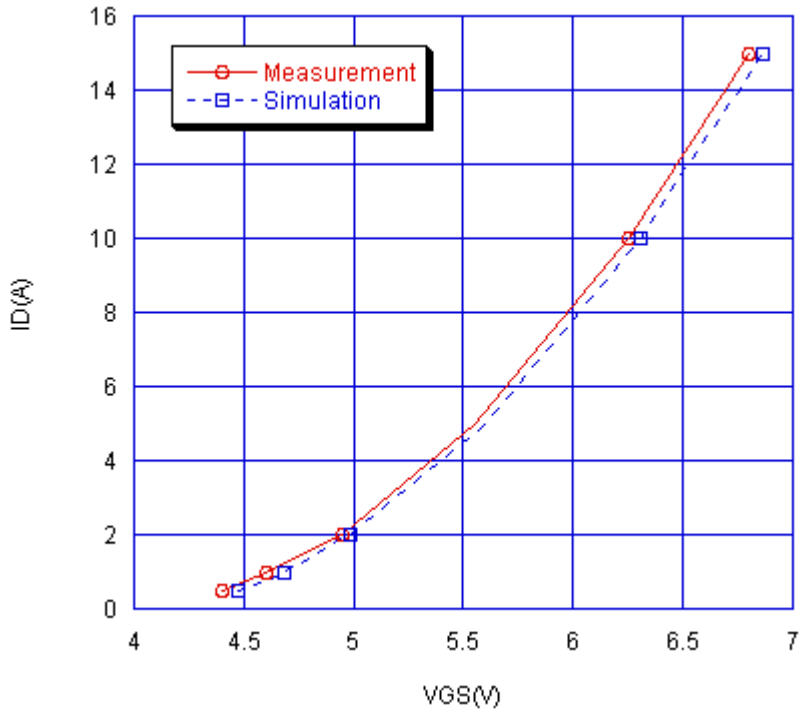


Evaluation circuit



Comparison Graph

Circuit Simulation Result

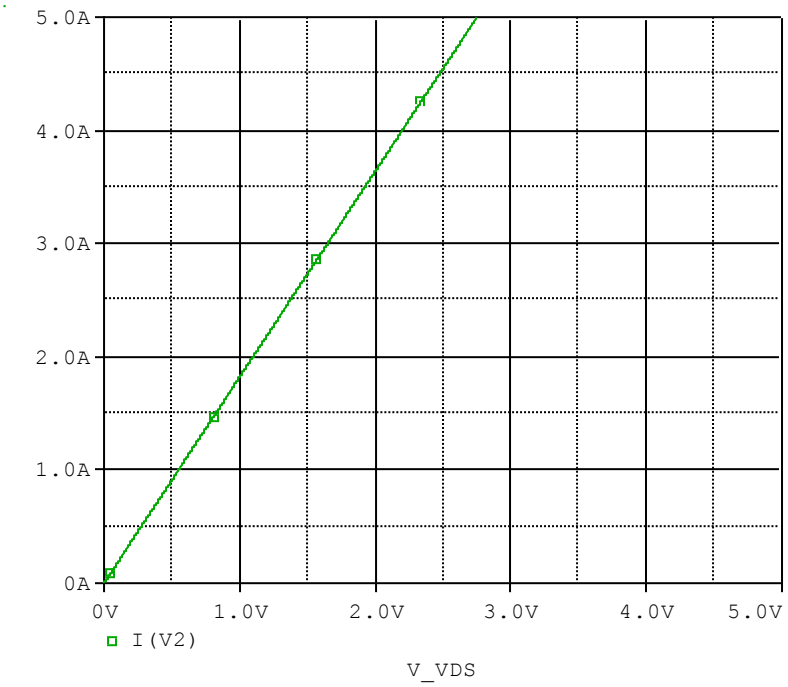


Simulation Result

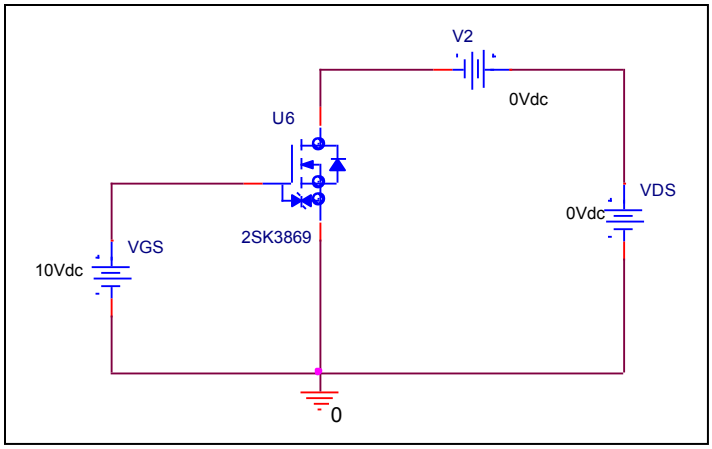
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.500	4.400	4.473	1.659
1.000	4.600	4.685	1.848
2.000	4.950	4.987	0.747
5.000	5.550	5.598	0.865
10.000	6.250	6.306	0.896
15.000	6.800	6.862	0.912

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

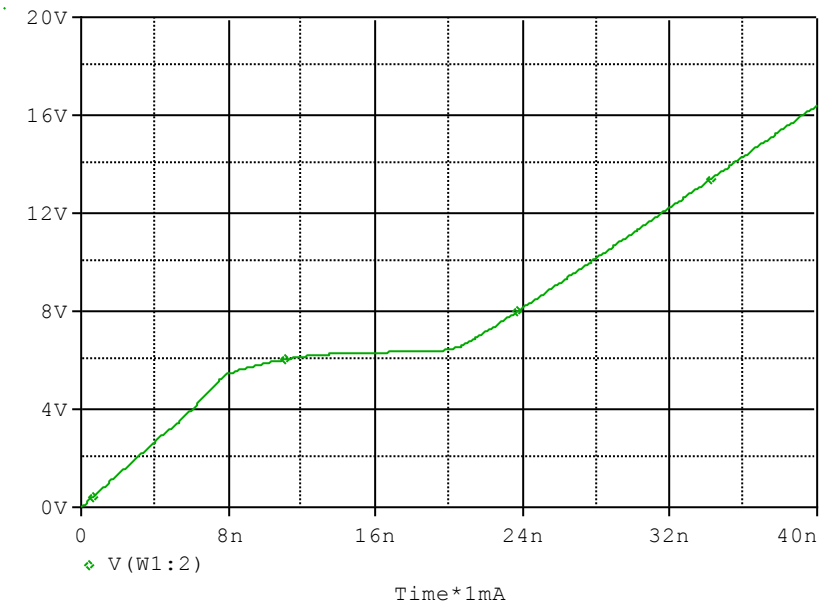


Simulation Result

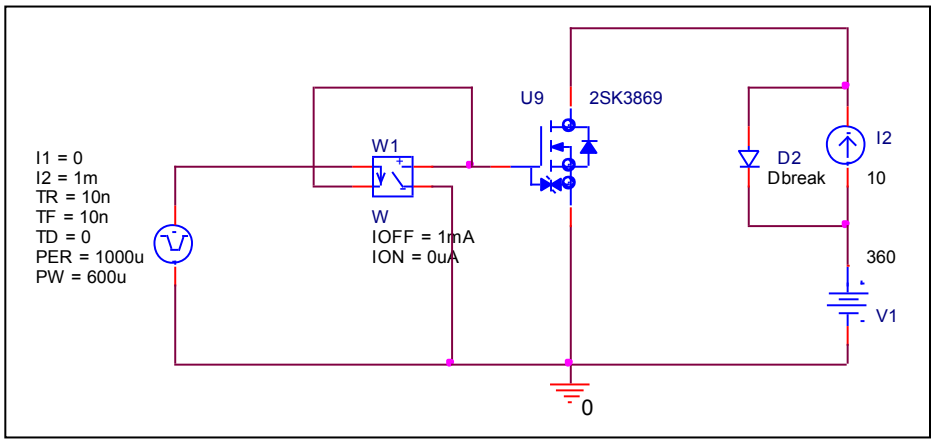
I_D=5A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	0.550	Ω	0.550	Ω	0.000

Gate Charge Characteristic

Circuit Simulation result



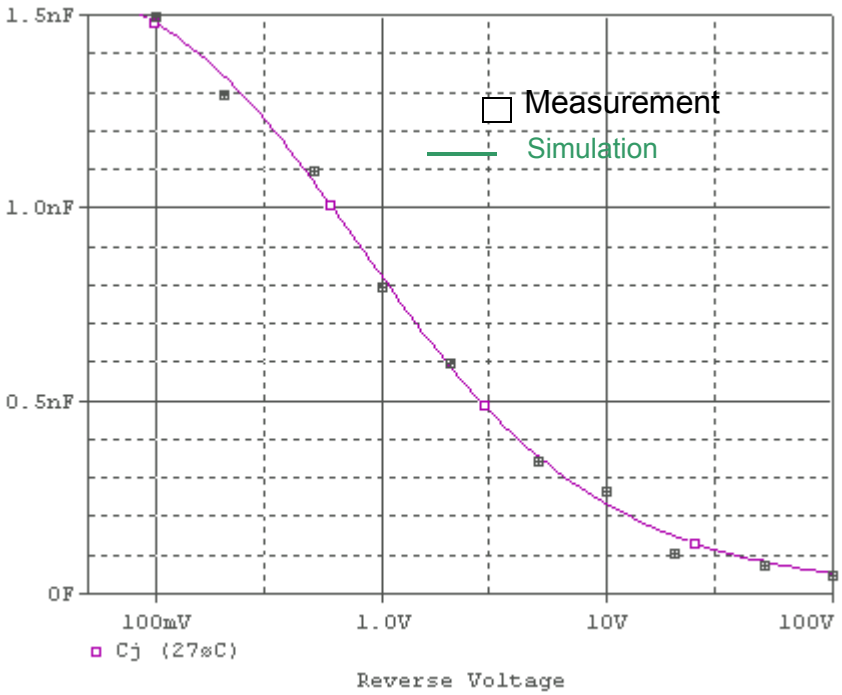
Evaluation circuit



Simulation Result

V_{DD}=360V,I_D= 10A ,V_{GS}=10V	Measurement		Simulation		Error (%)
Qgs	8	nC	8.018	nC	0.225
Qgd	12	nC	11.982	nC	-0.150
Qg	28	nC	27.703	nC	-1.060

Capacitance Characteristic

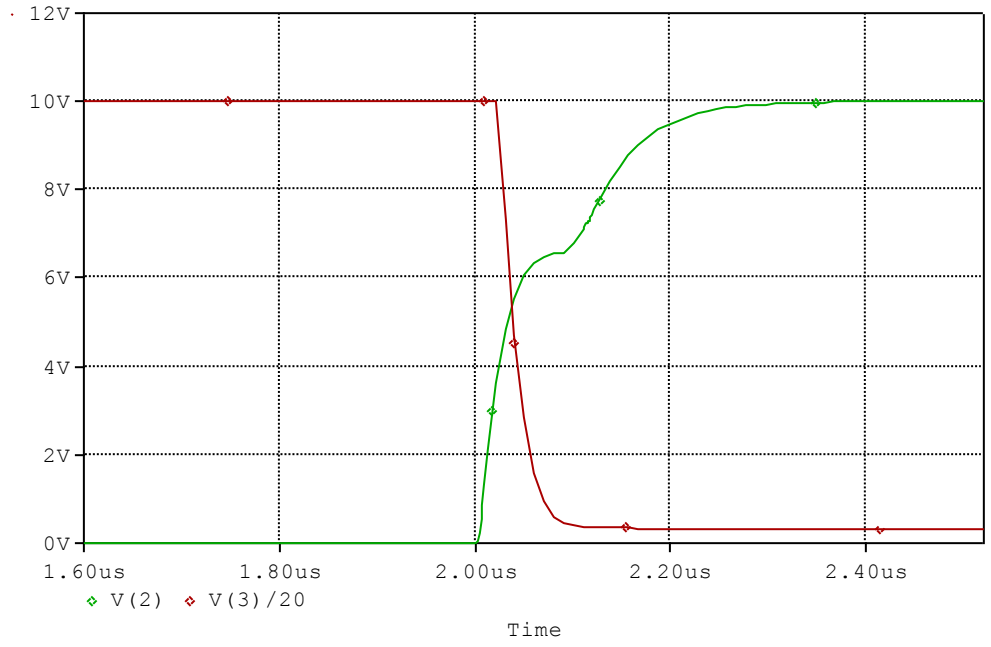


Simulation Result

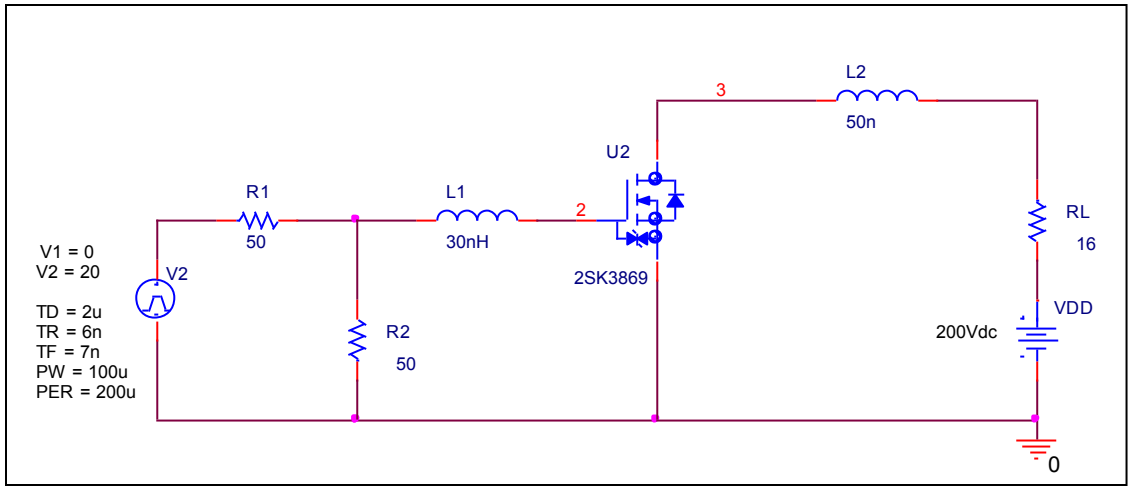
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	150.000	1490.000	-0.666
0.200	1300.000	1320.000	1.538
0.500	1150.000	1100.000	-4.347
1.000	800.000	810.000	1.250
2.000	600.000	600.000	0.000
5.000	350.000	355.000	1.428
10.000	270.000	280.000	3.703
20.000	108.000	103.000	-4.629
50.000	76.000	75.000	-1.315
100.000	53.000	54.00	1.886

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

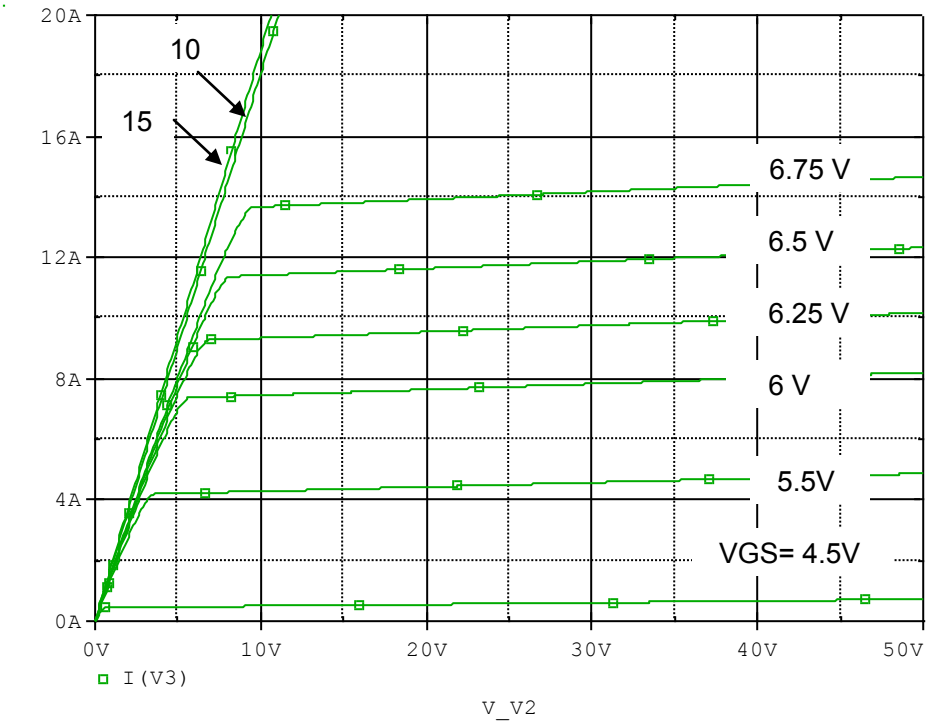


Simulation Result

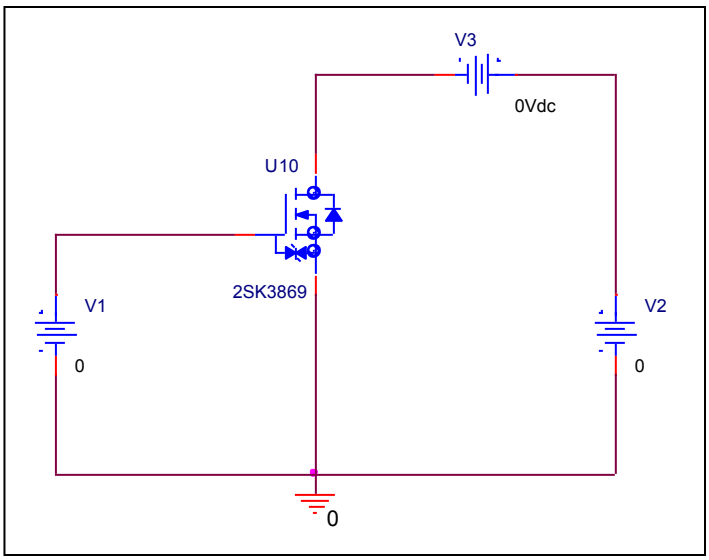
I_D= 5A, V_{DD}= 200V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	60.000	ns	60.440	ns	0.733

Output Characteristic

Circuit Simulation result

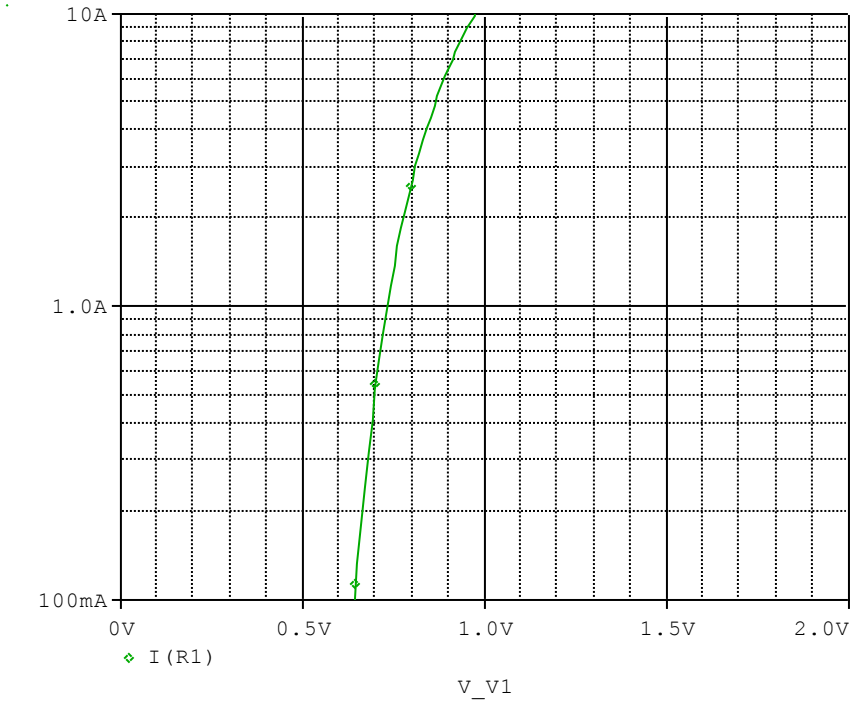


Evaluation circuit

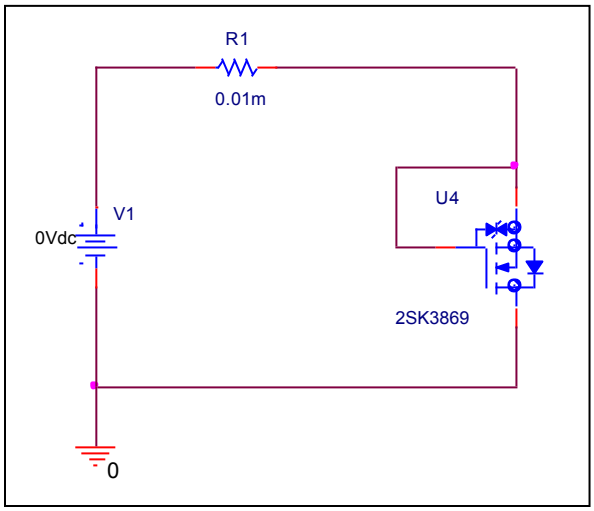


Forward Current Characteristic

Circuit Simulation Result

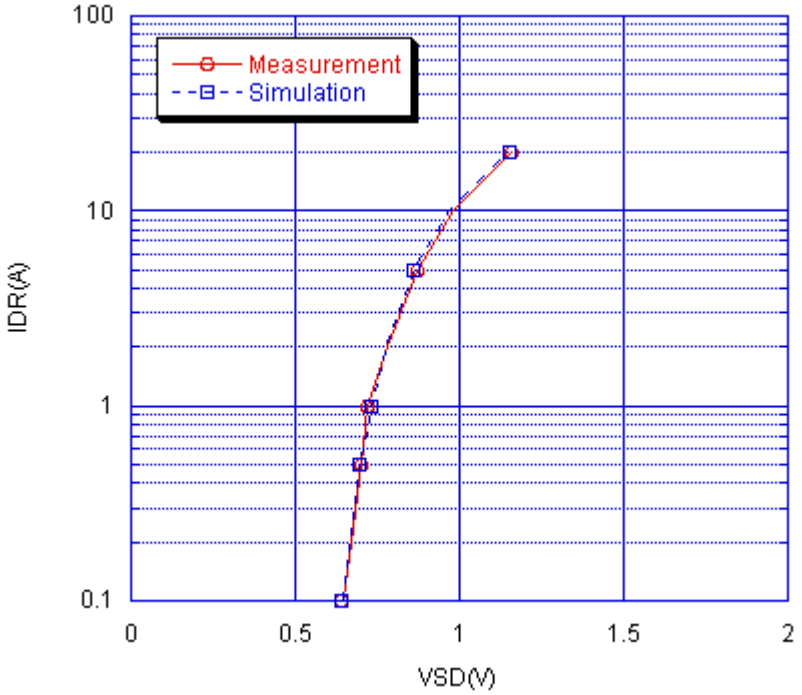


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

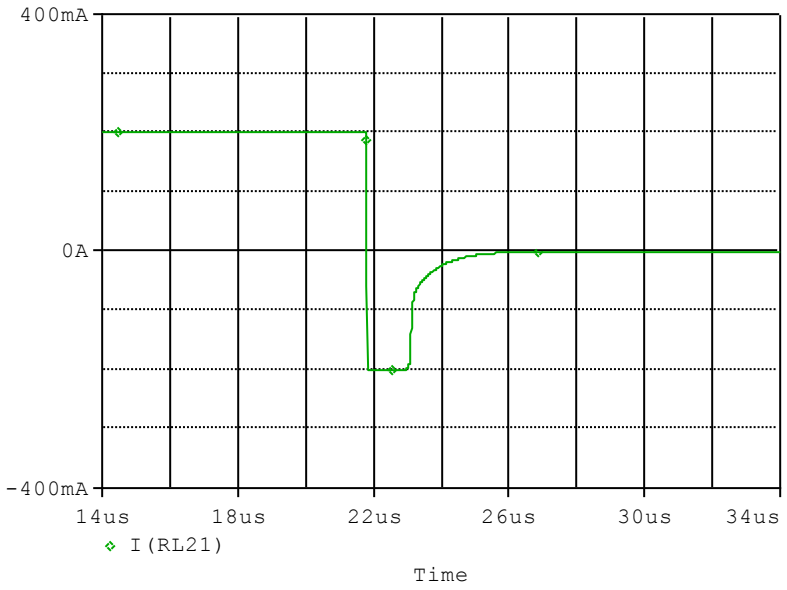


Simulation Result

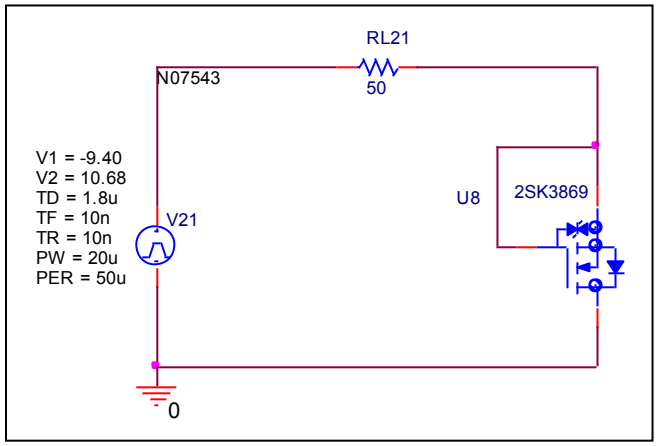
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.100	0.640	0.641	0.156
0.200	0.670	0.663	-1.045
0.500	0.70	0.698	-0.286
1.000	0.720	0.730	1.389
2.000	0.780	0.775	-0.641
5.000	0.870	0.863	-0.805
10.000	0.980	0.971	-0.918
20.000	1.160	1.150	-0.862

Reverse Recovery Characteristic

Circuit Simulation Result



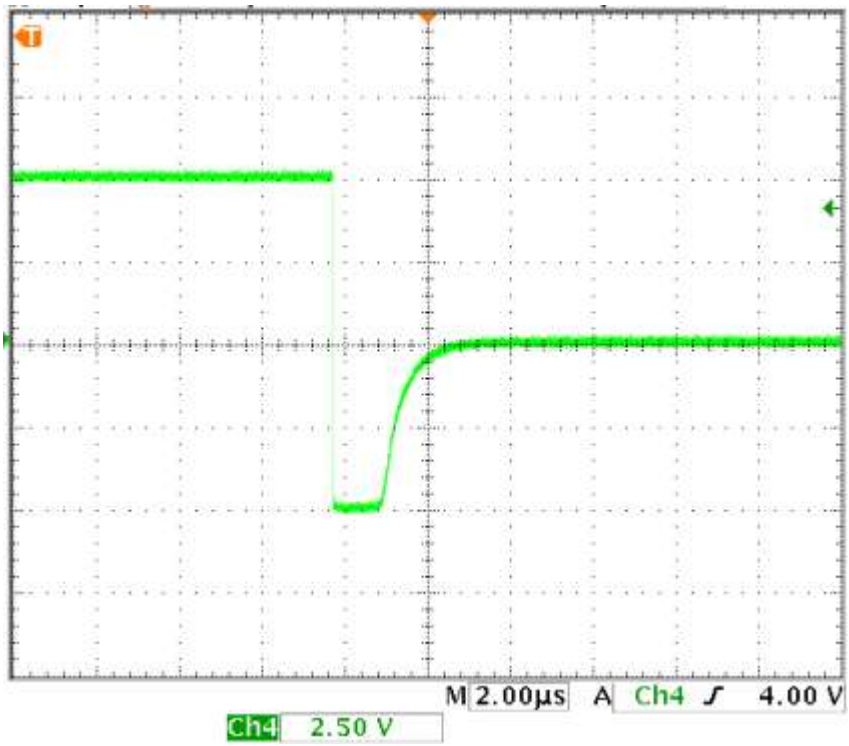
Evaluation Circuit



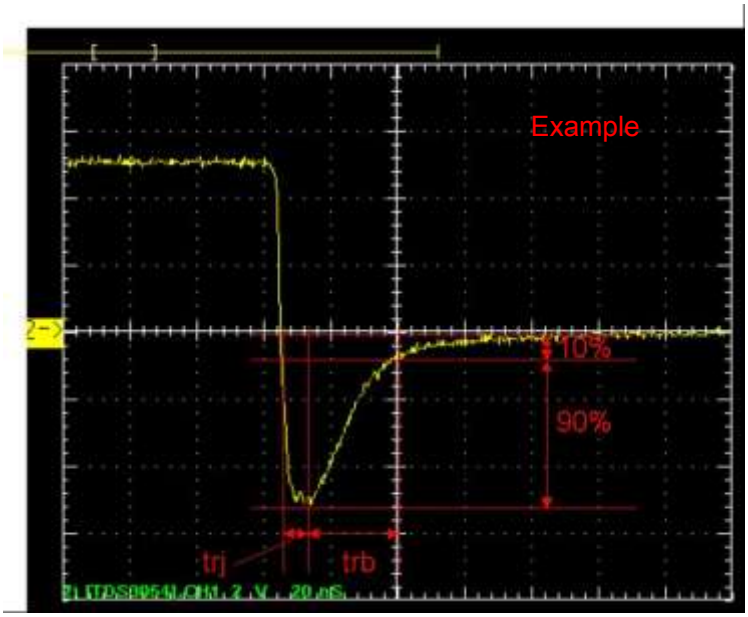
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	1.20	us	1.207	us	0.608
trb	1.12	us	1.113	us	-0.571
trr	2.32	us	2.320	us	0.038

Reverse Recovery Characteristic Reference



Trj=1.20(us)
Trb=1.12(us)
Conditions:Ifwd=Irev=0.2(A),Rl=50



Relation between trj and trb

Zener Voltage Characteristic Reference