Device Modeling Report

COMPONENTS: MOSFET (Model Parameters)
PART NUMBER: 2SJ349
MANUFACTURER: TOSHIBA
Body Diode (Model Parameters) / ESD Protection

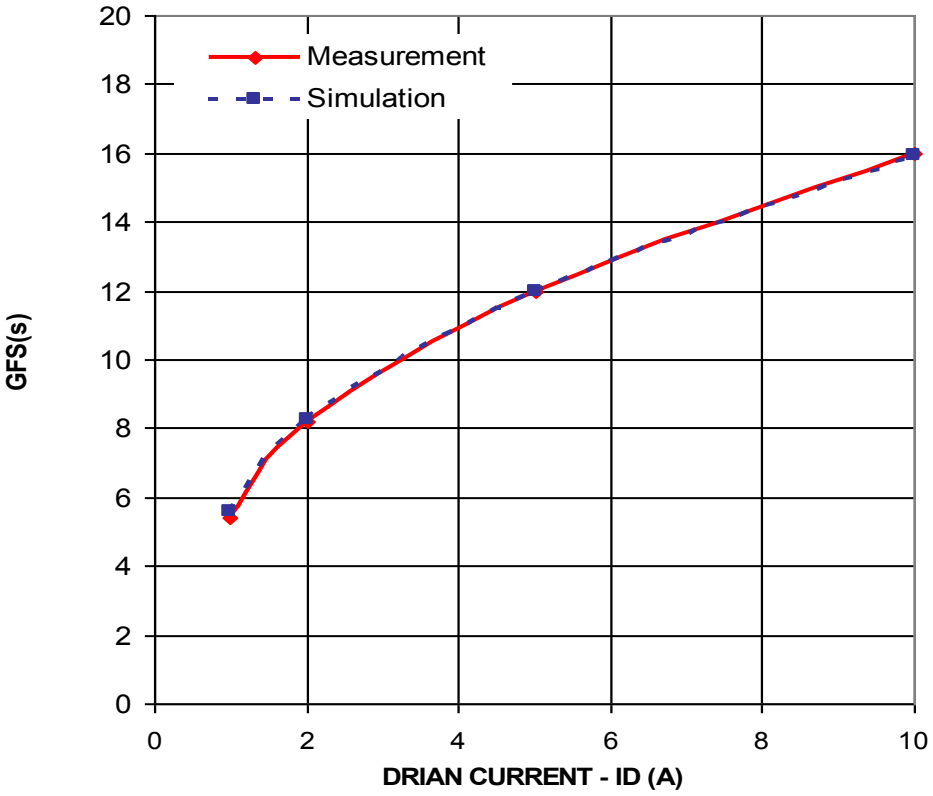
Bee Technologies Inc.

MOSFET MODEL PARAMETERS

PSpice model parameters	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

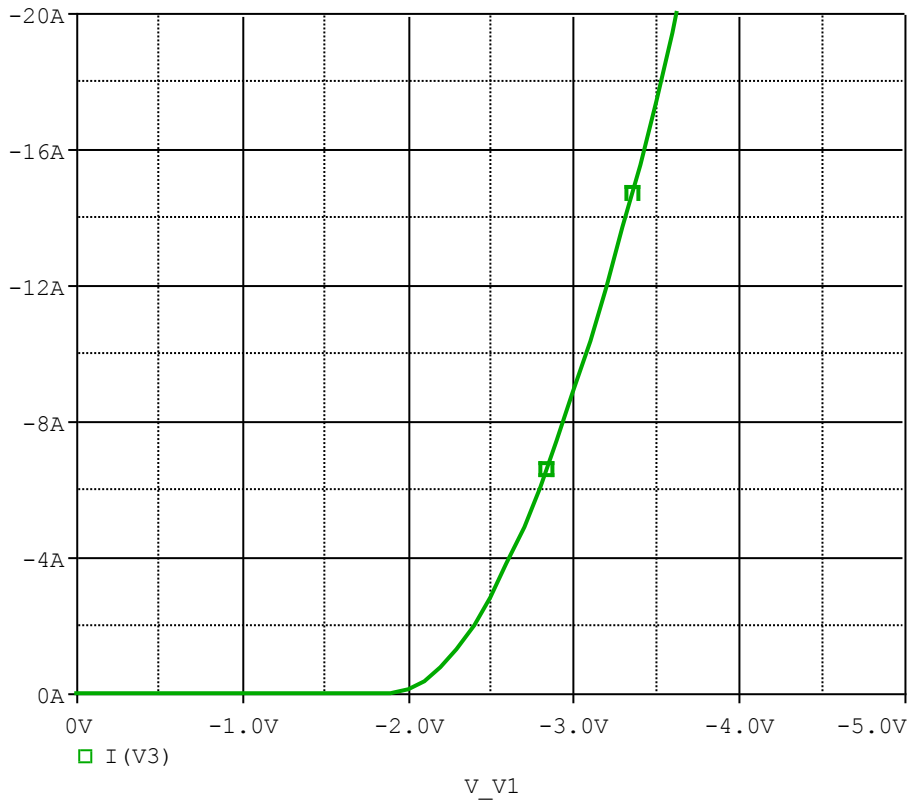


Comparison table

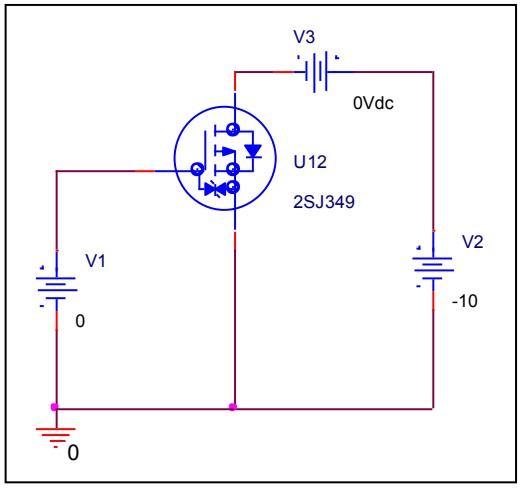
Id(A)	Gfs(S)		Error(%)
	Measurement	Simulation	
-1.000	5.400	5.556	2.889
-2.000	8.200	8.245	0.549
-5.000	12.000	11.992	-0.067
-10.000	16.000	15.920	-0.500

Vgs-Id Characteristic

Circuit Simulation result

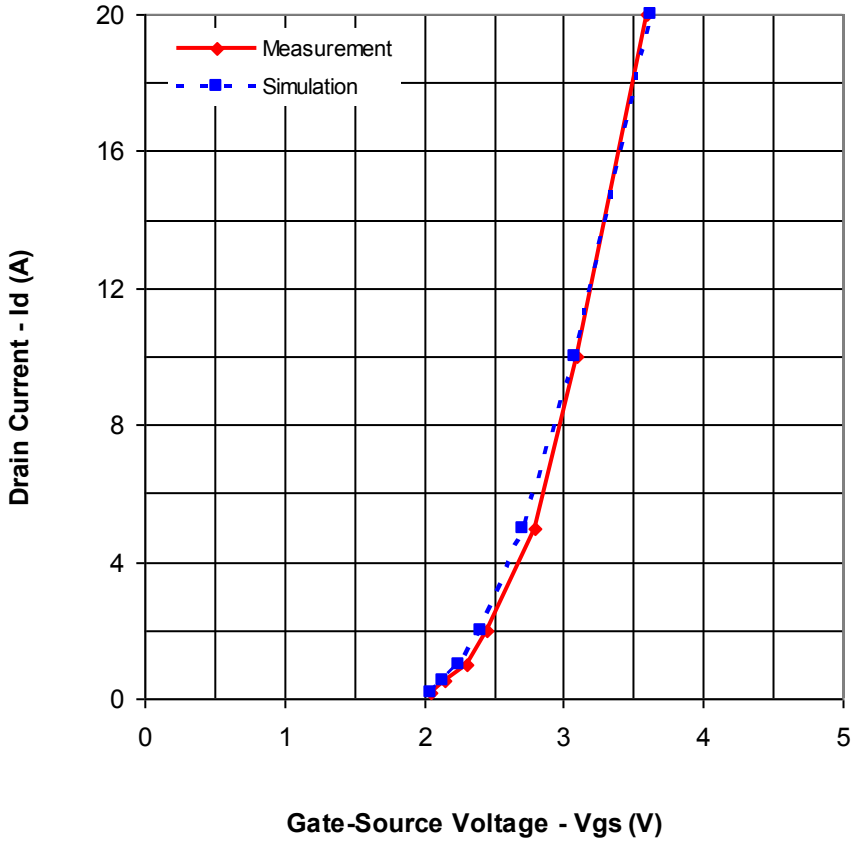


Evaluation circuit



Comparison Graph

Circuit Simulation Result

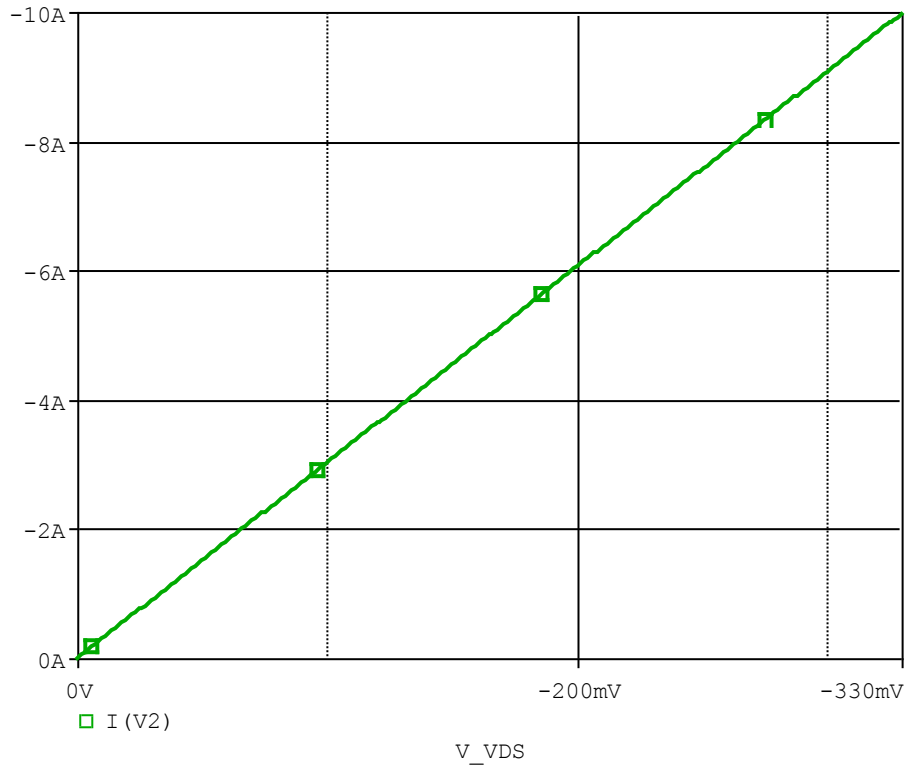


Simulation Result

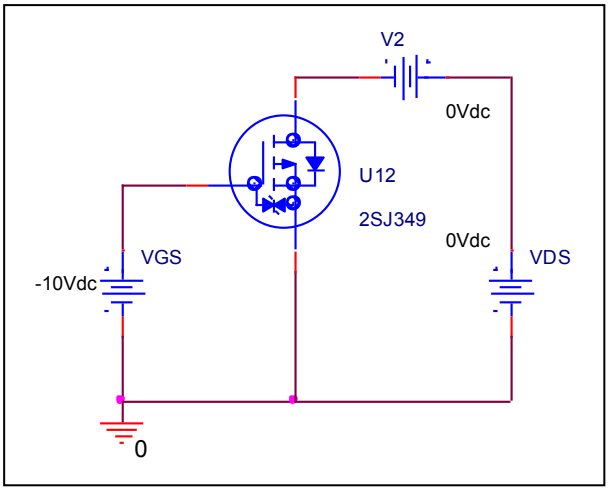
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
-0.200	-2.050	-2.043	-0.341
-0.500	-2.150	-2.136	-0.651
-1.000	-2.300	-2.245	-2.391
-2.000	-2.450	-2.401	-2.000
-5.000	-2.800	-2.710	-3.214
-10.000	-3.100	-3.078	-0.710
-20.000	-3.600	-3.628	0.778

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

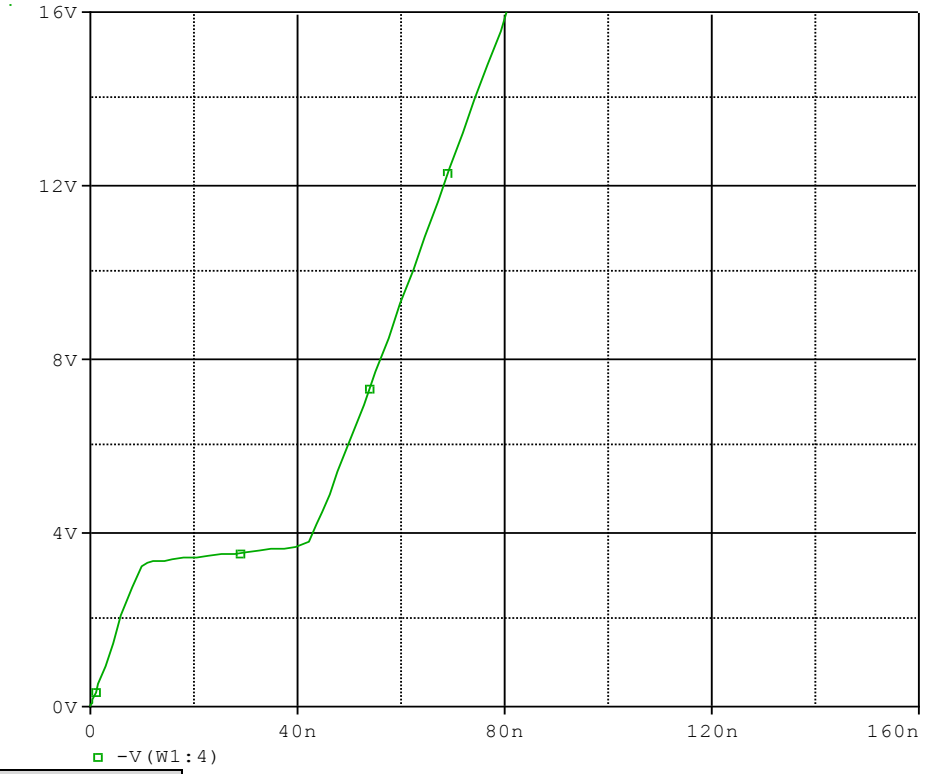


Simulation Result

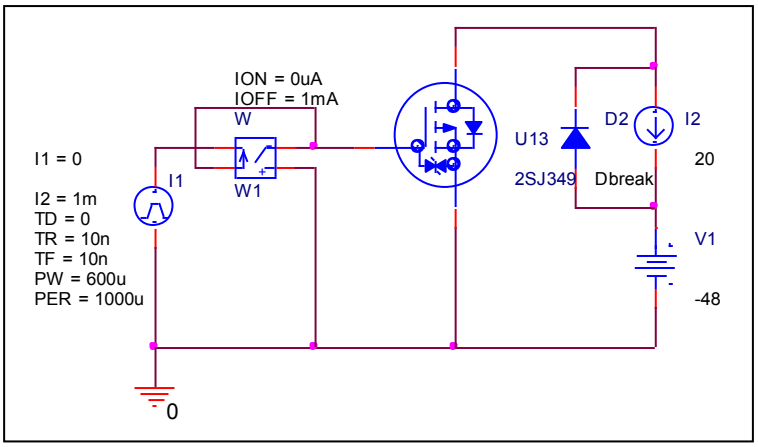
I_D=-10A, V_{GS}=-10V	Measurement		Simulation		Error (%)
R_{DS} (on)	33.000	mΩ	33.000	mΩ	0.000

Gate Charge Characteristic

Circuit Simulation Result



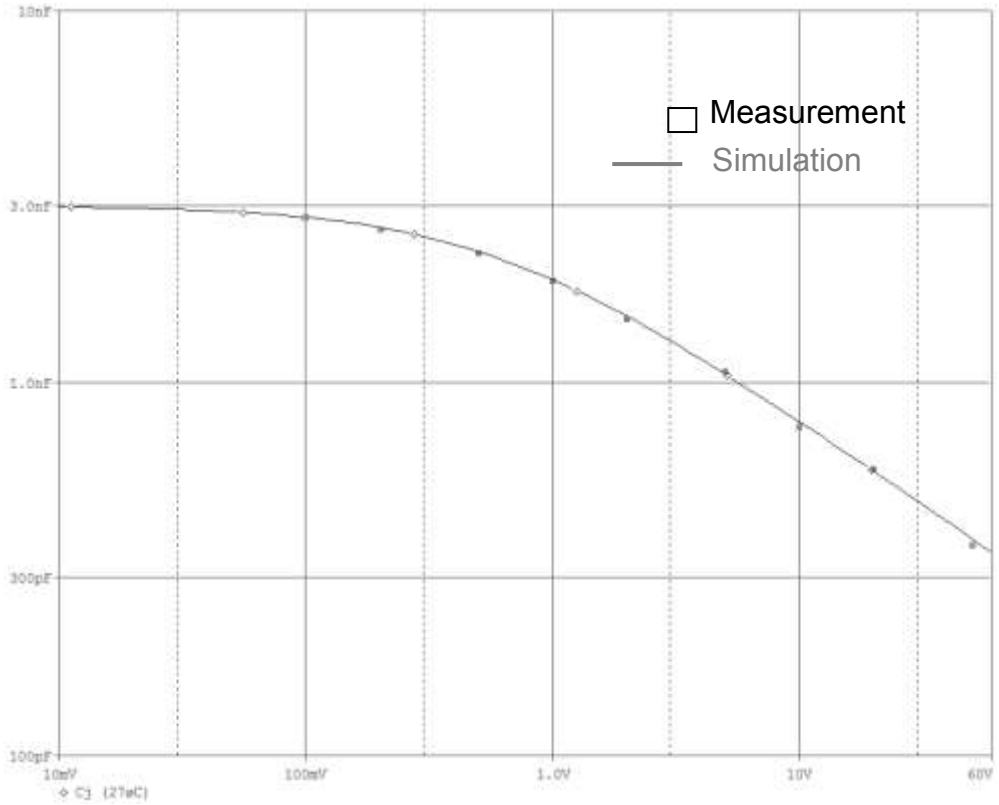
Evaluation Circuit



Simulation Result

V_{DD}=-48V, I_D= -20A ,V_{GS}=-10V	Measurement		Simulation		Error (%)
Qgs	10.000	nC	10.070	nC	0.700
Qgd	31.000	nC	31.049	nC	0.158
Qg	90.000	nC	62.062	nC	0.100

Capacitance Characteristic

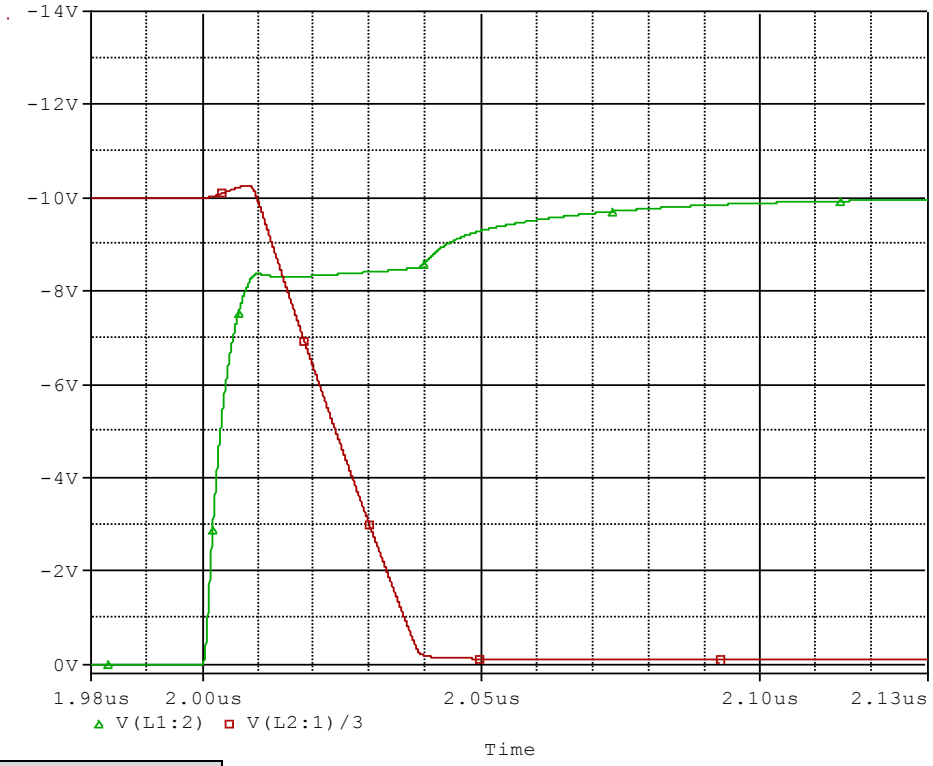


Simulation Result

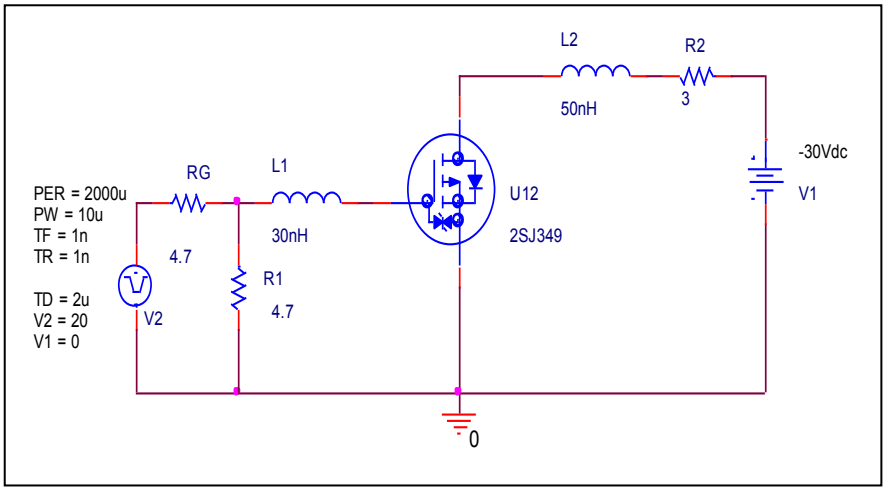
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	2800.000	2750.000	-1.786
0.200	2500.000	2550.000	2.000
0.500	2200.000	2200.000	0.000
1.000	1900.000	1900.000	0.000
2.000	1500.000	1550.000	3.333
5.000	1080.000	1100.000	1.852
10.000	750.000	770.000	2.667
20.000	590.000	590.000	0.000
50.000	370.000	360.000	-2.703

Switching Time Characteristic

Circuit Simulation Result



Evaluation Circuit

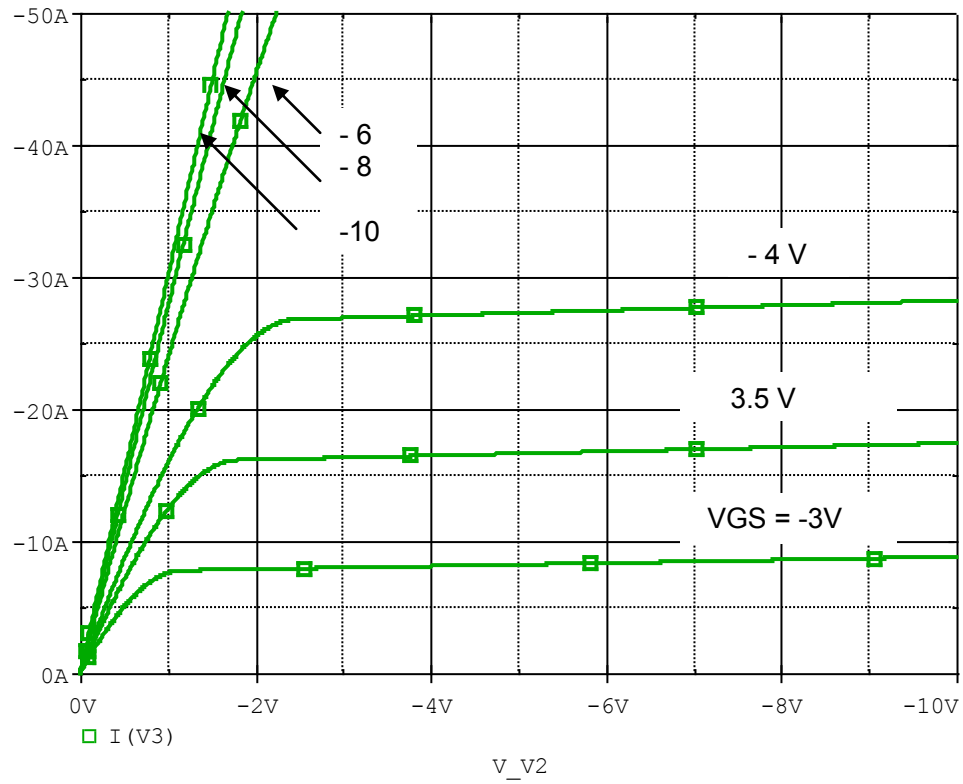


Simulation Result

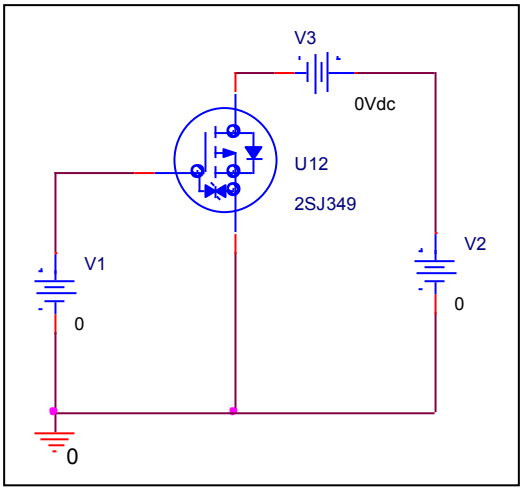
I_D=-10A, V_{DD}= -30V, V_{GS}=-10V	Measurement		Simulation		Error(%)
Td(on)	35.000	ns	35.313	ns	0.894

Output Characteristic

Circuit Simulation Result

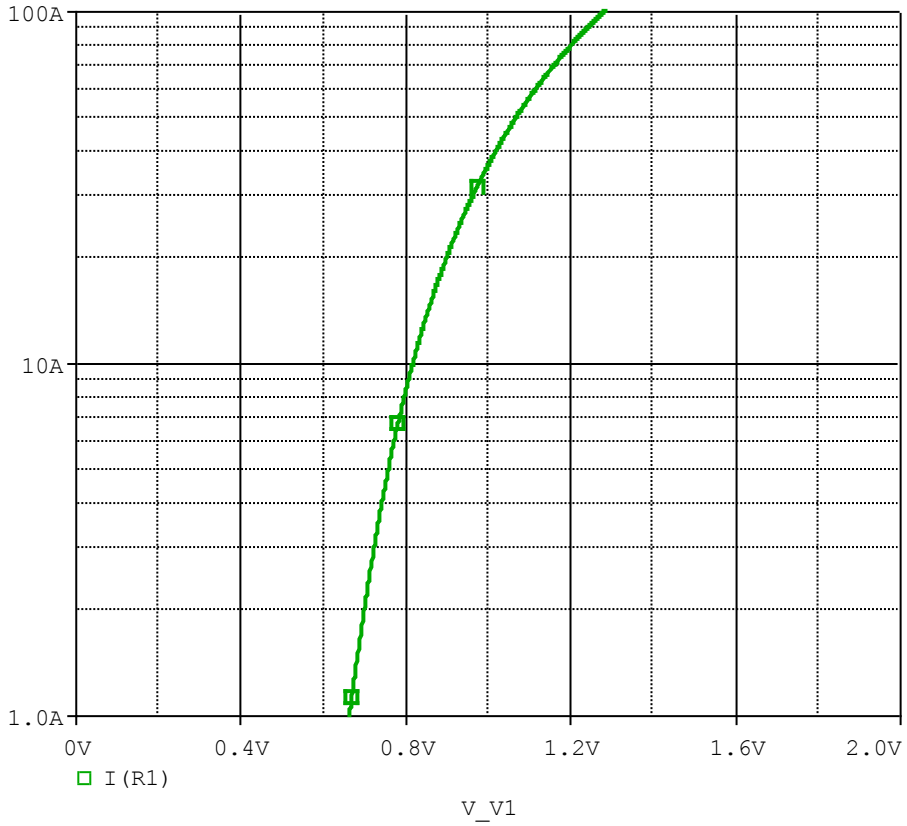


Evaluation Circuit

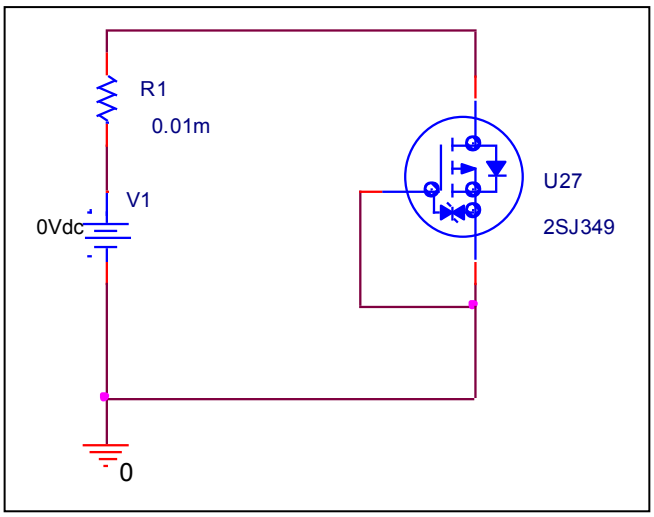


BODY DIODE
Forward Current Characteristic

Circuit Simulation Result

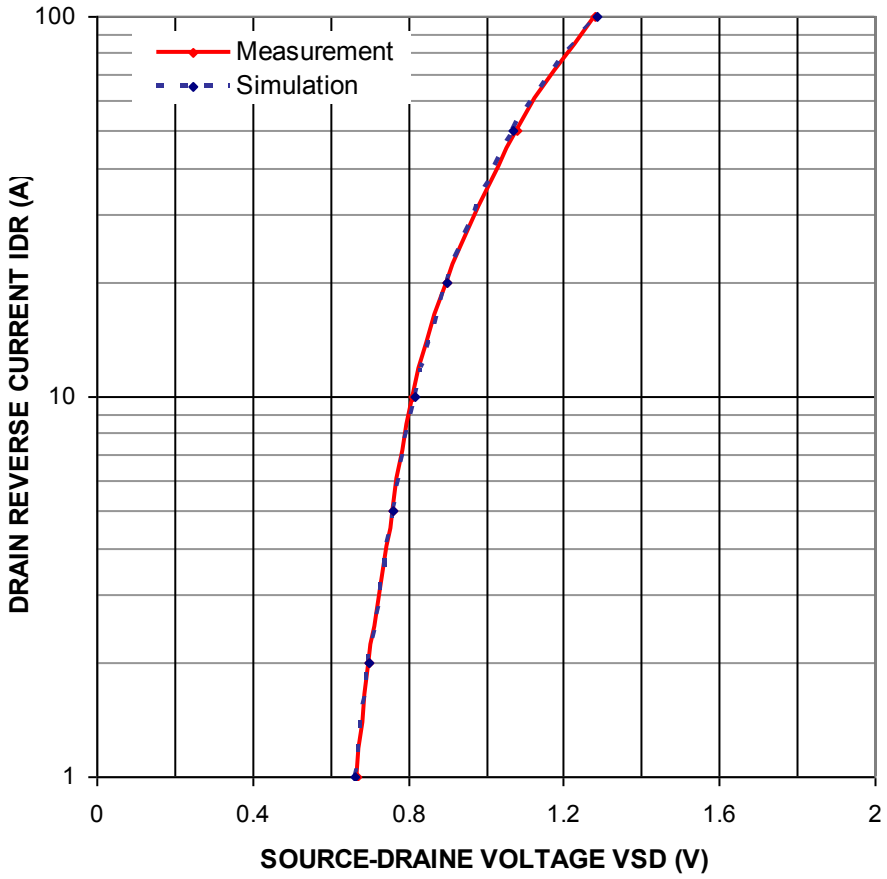


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

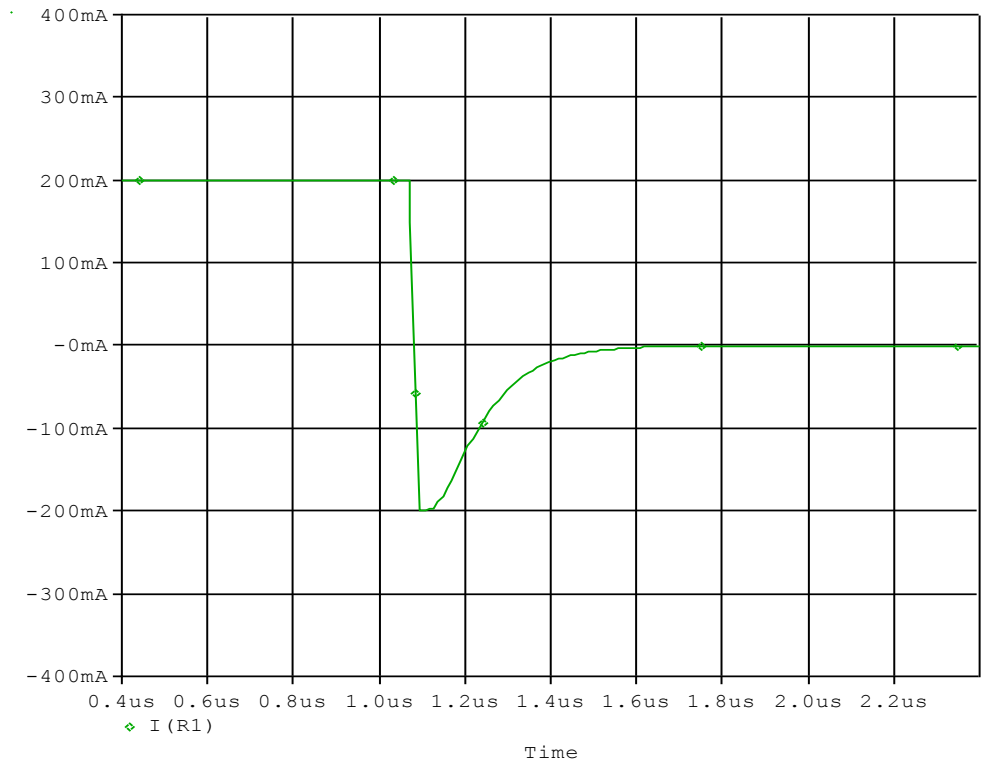


Simulation Result

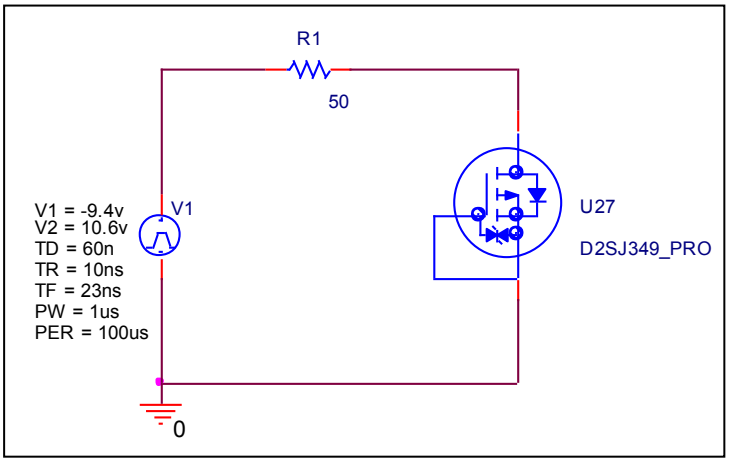
IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
1.000	0.670	0.665	-0.746
2.000	0.700	0.701	0.143
5.000	0.760	0.759	-0.132
10.000	0.810	0.819	1.111
20.000	0.900	0.901	0.111
50.000	1.080	1.071	-0.833
100.000	1.280	1.286	0.469

Reverse Recovery Characteristic (Body Diode)

Circuit Simulation Result



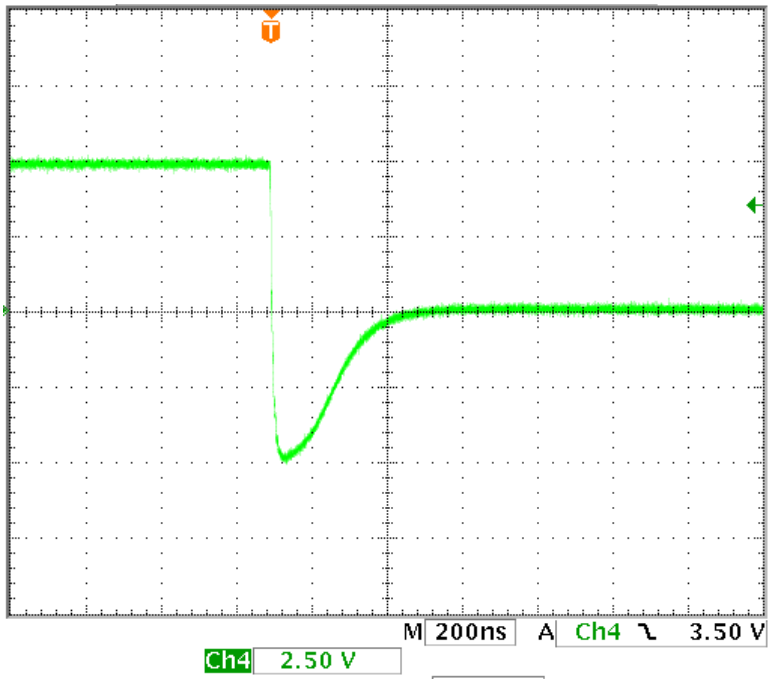
Evaluation Circuit



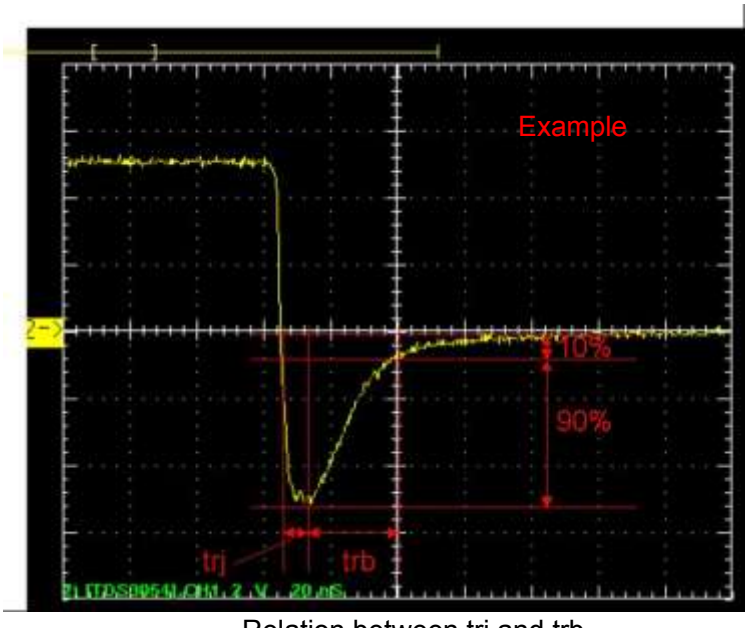
Compare Measurement vs. Simulation

Trr	Measurement	Simulation	Error (%)
Trj+trb(ns)	317.000	317.353	0.111

Reverse Recovery Characteristic (Body Diode) Reference



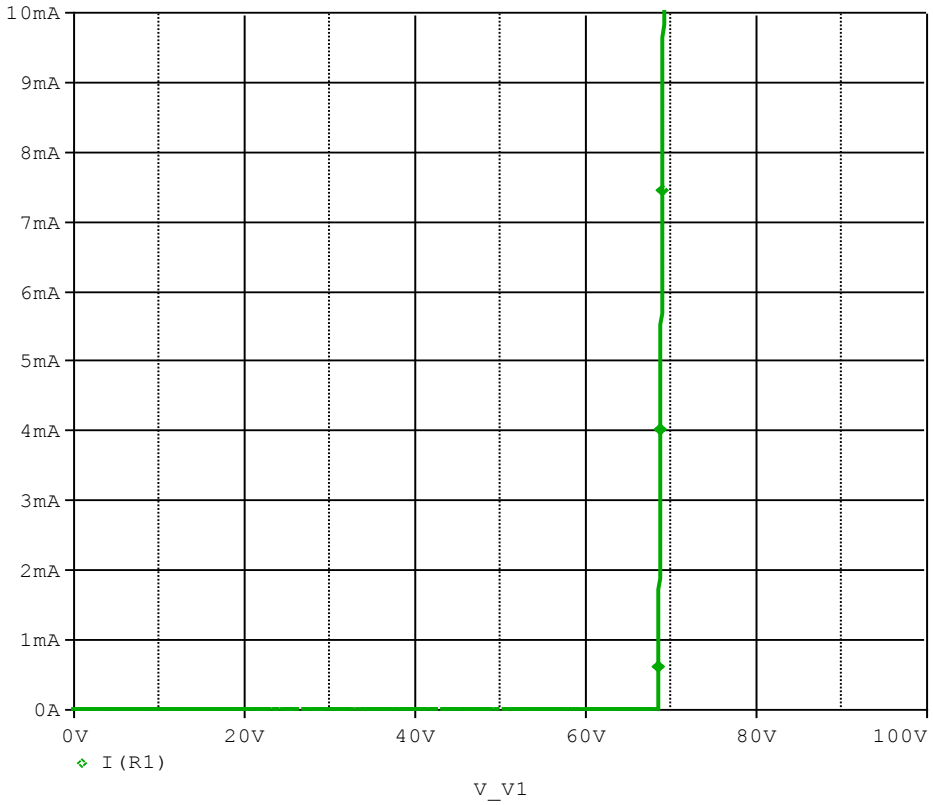
Trj= (72ns)
Trb= (245ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



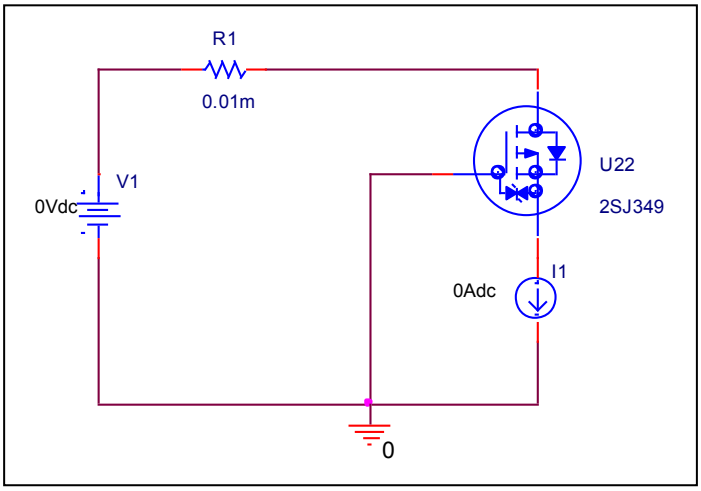
Relation between trj and trb

ESD PROTECTION DIODE
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference