Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameters)
PART NUMBER: 2SJ650
MANUFACTURER: SANYO
Body Diode (Model Parameters) / ESD Protection Diode

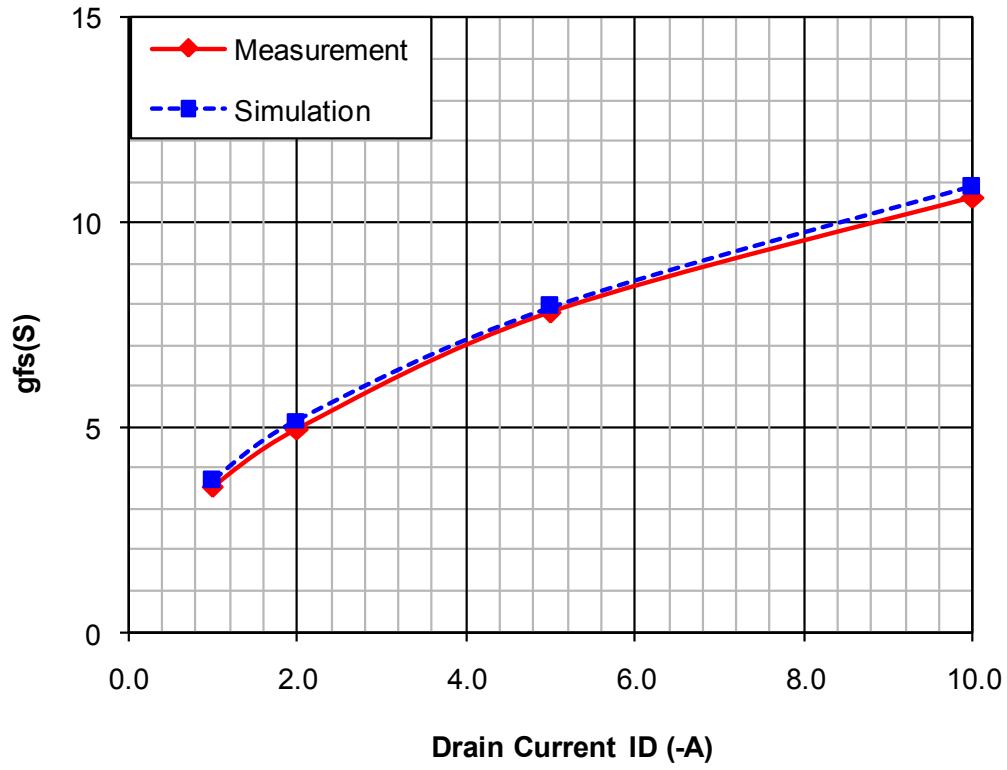
Bee Technologies Inc.

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

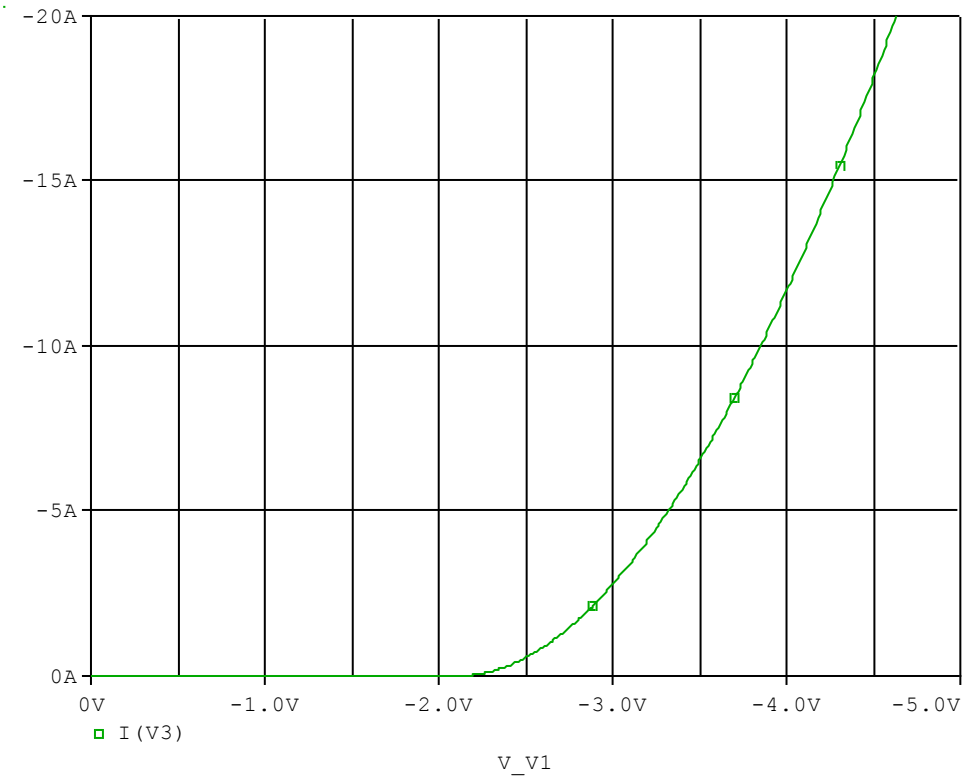


Comparison table

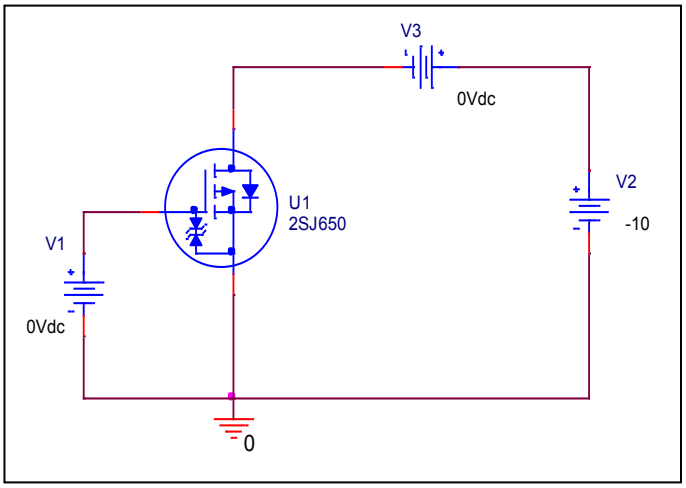
-Id(A)	gfs(S)		Error (%)
	Measurement	Simulation	
1.0000	3.550	3.707	4.42
2.0000	4.950	5.162	4.28
5.0000	7.800	7.928	1.64
10.0000	10.600	10.862	2.47

Vgs-Id Characteristic

Circuit Simulation result

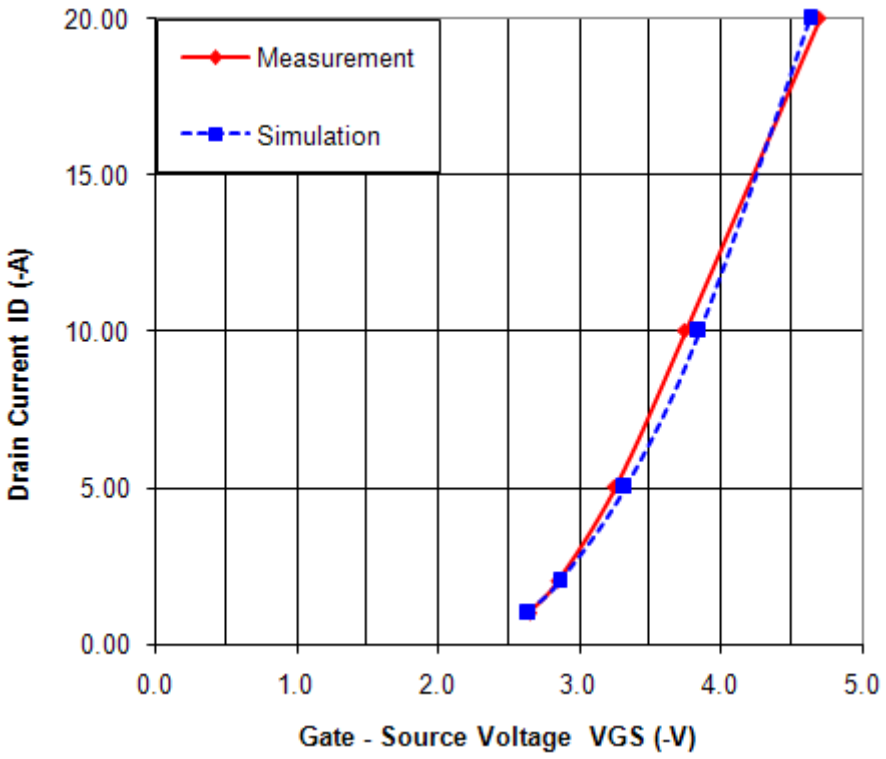


Evaluation circuit



Comparison Graph

Circuit Simulation Result

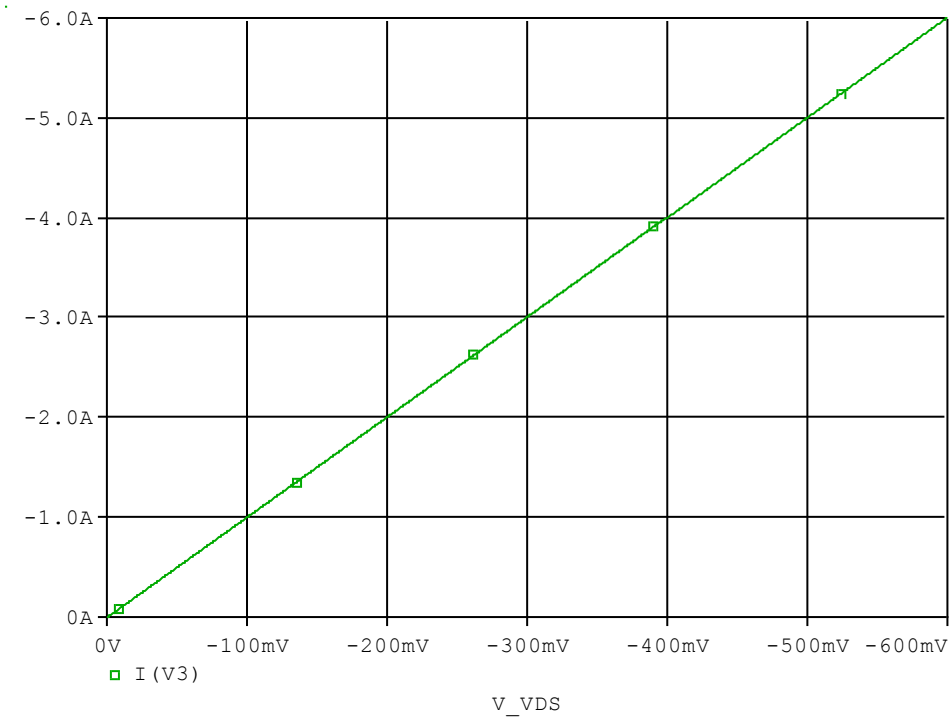


Simulation Result

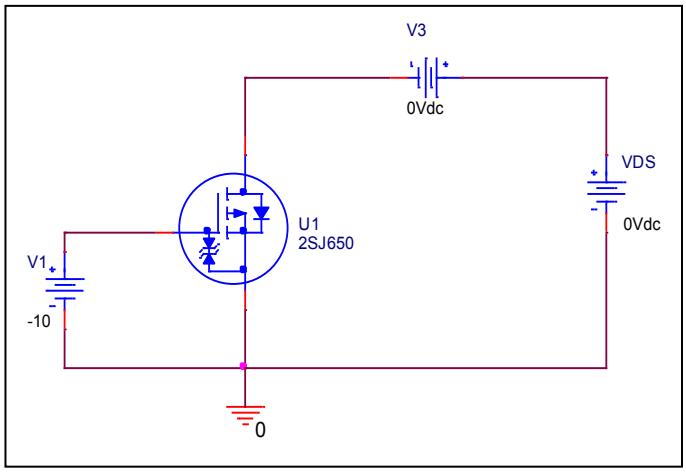
$-I_D$(A)	$-V_{GS}$(V)		Error (%)
	Measurement	Simulation	
1	2.650	2.638	-0.47
2	2.850	2.863	0.45
5	3.250	3.320	2.15
10	3.750	3.851	2.69
20	4.700	4.632	-1.46

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

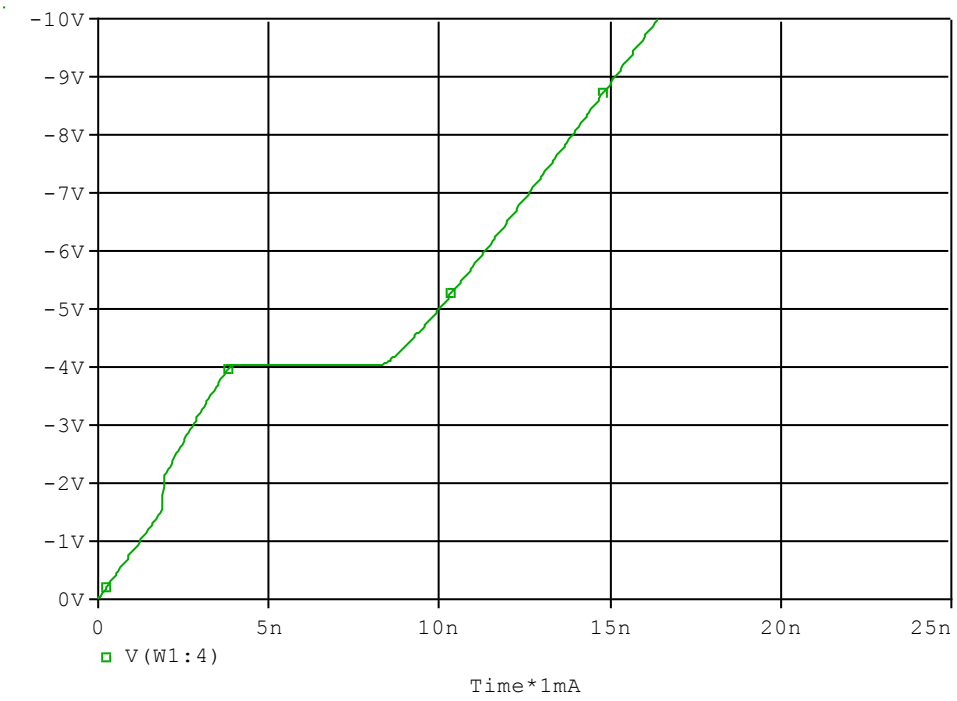


Simulation Result

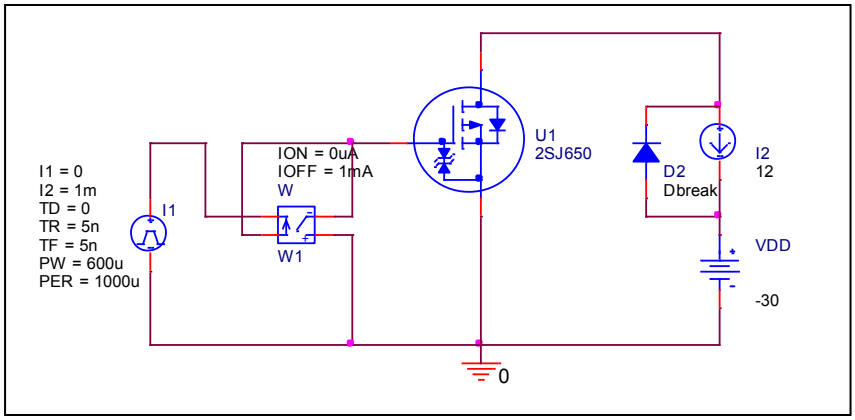
I_D=-6A, V_{GS}=-10V		Measurement	Simulation	Error (%)
R_{DS} (on)	mΩ	100.000	100.000	0.00

Gate Charge Characteristic

Circuit Simulation result



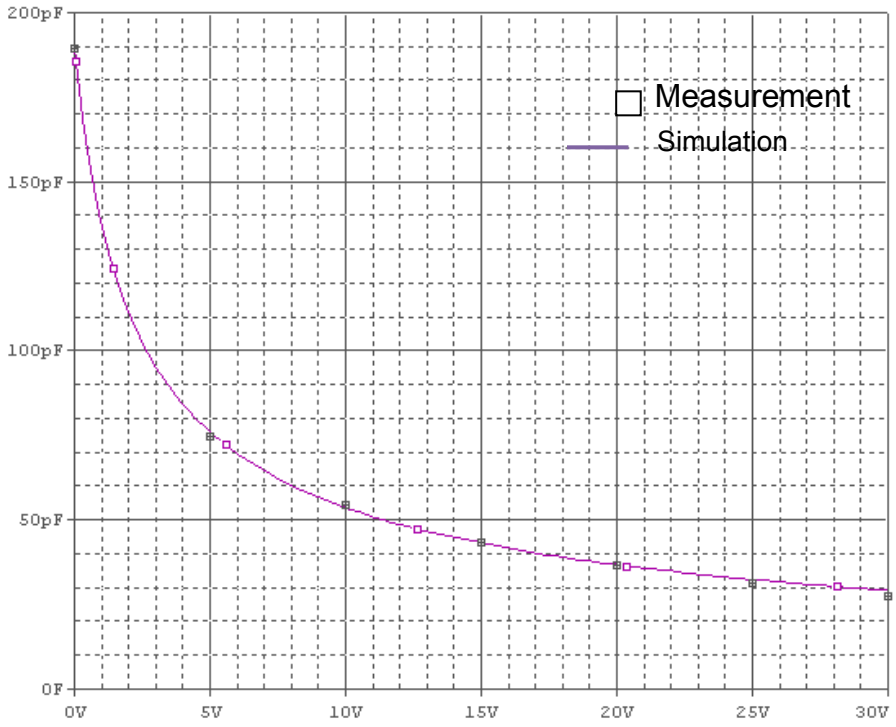
Evaluation circuit



Simulation Result

V_{DD}=-30V,I_D=-12A ,V_{GS}=-10V		Measurement	Simulation	Error (%)
Qgs	nC	3.800	3.868	1.79
Qgd	nC	4.500	4.480	-0.45
Qg	nC	21.000	16.400	-21.90

Capacitance Characteristic

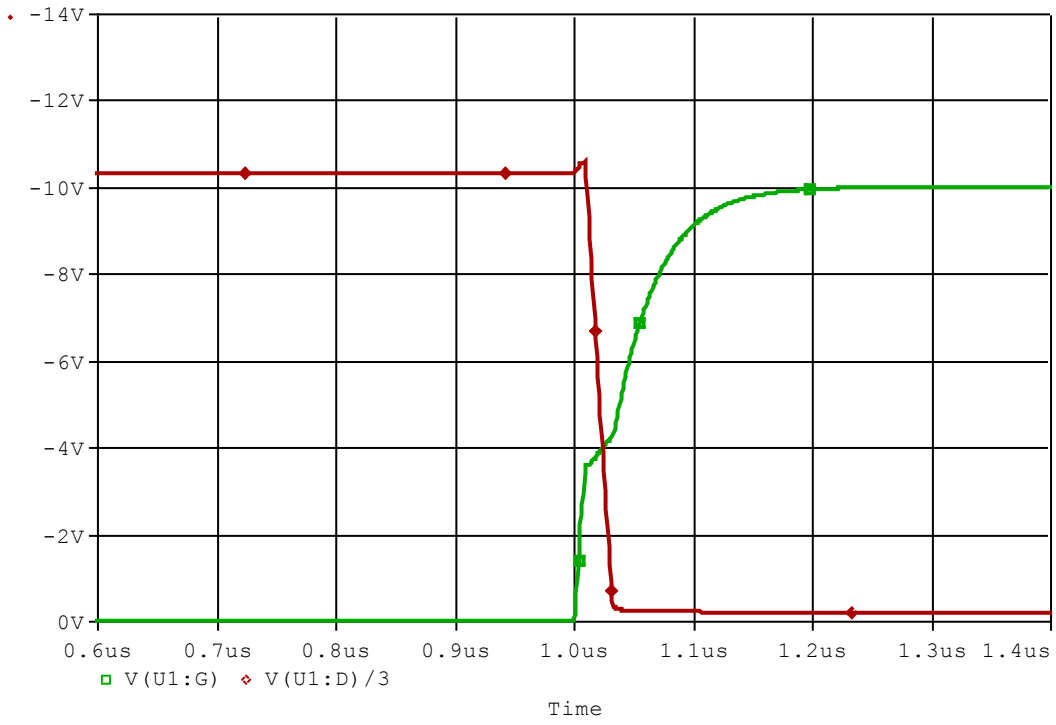


Simulation Result

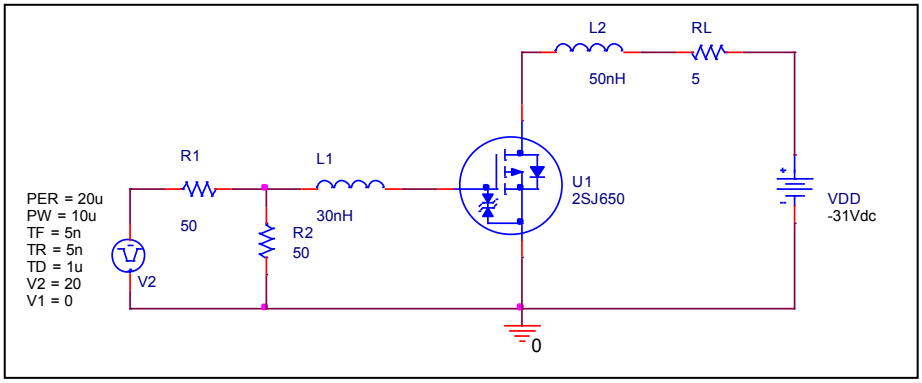
V_{SD}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0	190.000	190.000	0.000
5	75.000	75.940	1.253
10	54.000	53.680	-0.593
15	43.000	43.153	0.356
20	37.000	36.783	-0.586
25	32.000	32.429	1.341
30	29.000	29.224	0.772

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

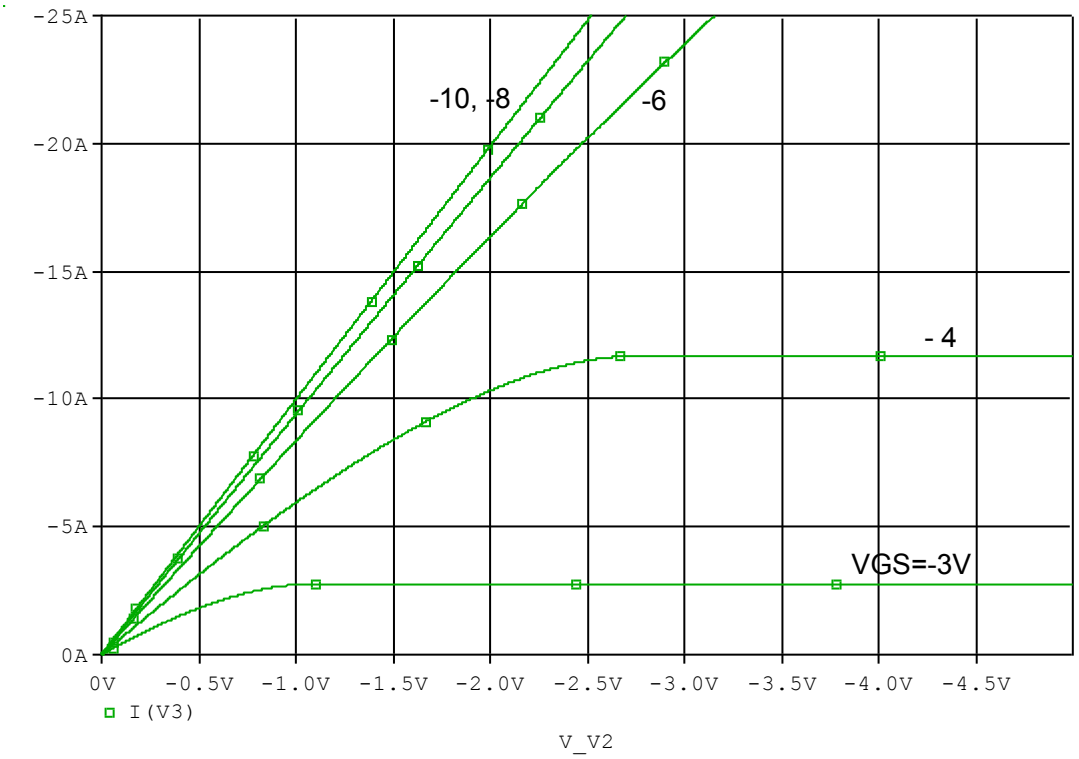


Simulation Result

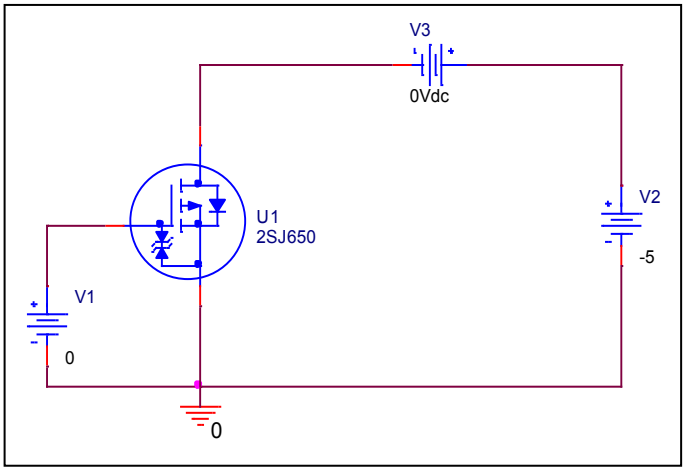
I_D=-6A, V_{DD}=-30V V_{GS}=0/-10V		Measurement	Simulation	Error(%)
td(on)	ns	10.000	10.012	0.12

Output Characteristic

Circuit Simulation result

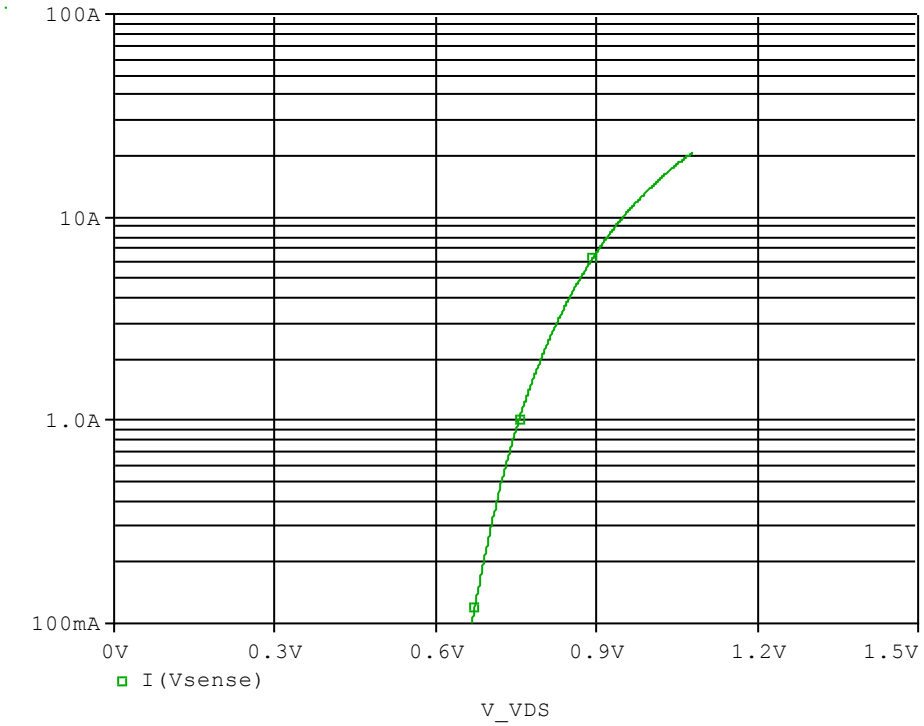


Evaluation circuit

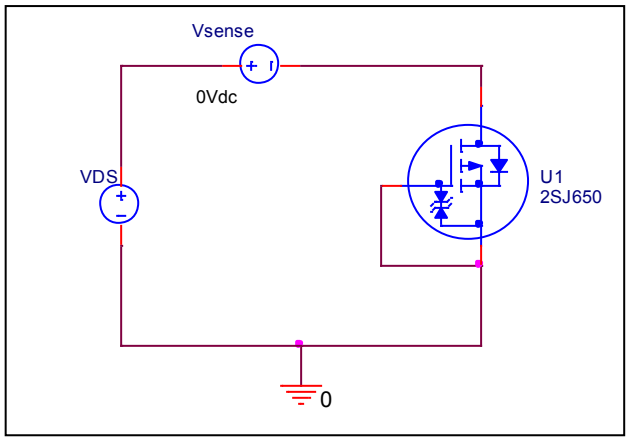


BODY DIODE SPICE MODEL
Forward Current Characteristic

Circuit Simulation Result

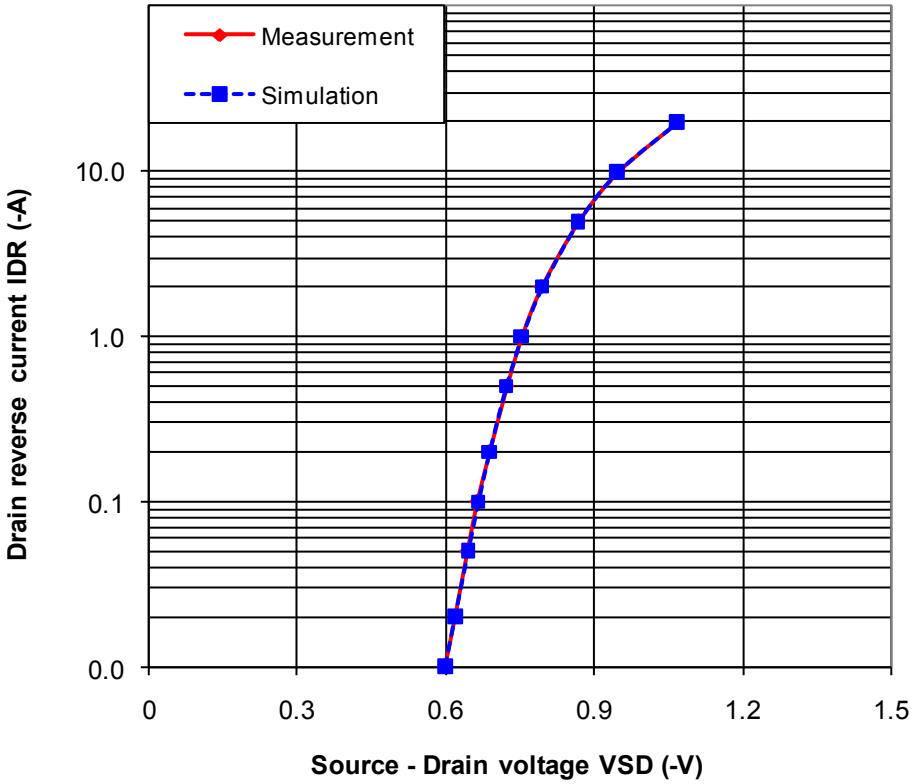


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

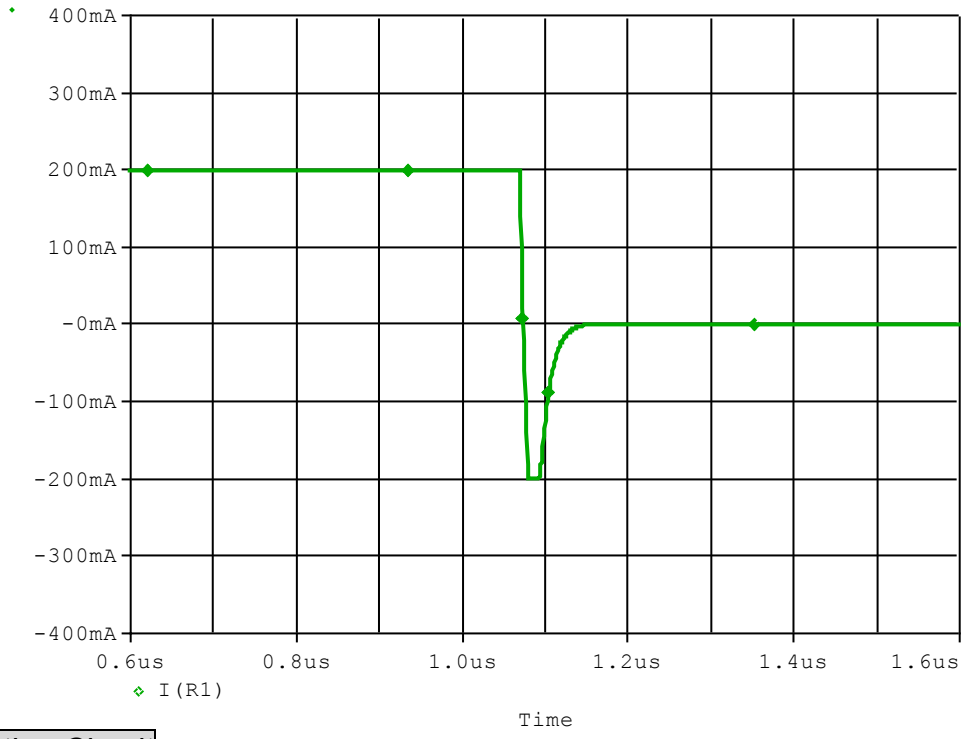


Simulation Result

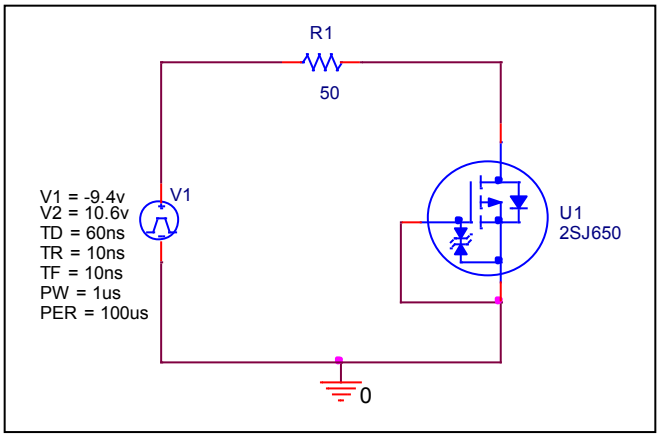
IDR(-A)	VSD(-V)		%Error
	Measurement	Simulation	
0.01	0.6000	0.5994	-0.10
0.02	0.6200	0.6193	-0.11
0.05	0.6450	0.6461	0.17
0.1	0.6650	0.6670	0.31
0.2	0.6900	0.6893	-0.10
0.5	0.7250	0.7231	-0.26
1	0.7550	0.7551	0.02
2	0.7950	0.7962	0.15
5	0.8700	0.8698	-0.02
10	0.9500	0.9494	-0.06
20	1.0700	1.0703	0.03

Reverse Recovery Characteristic

Circuit Simulation Result



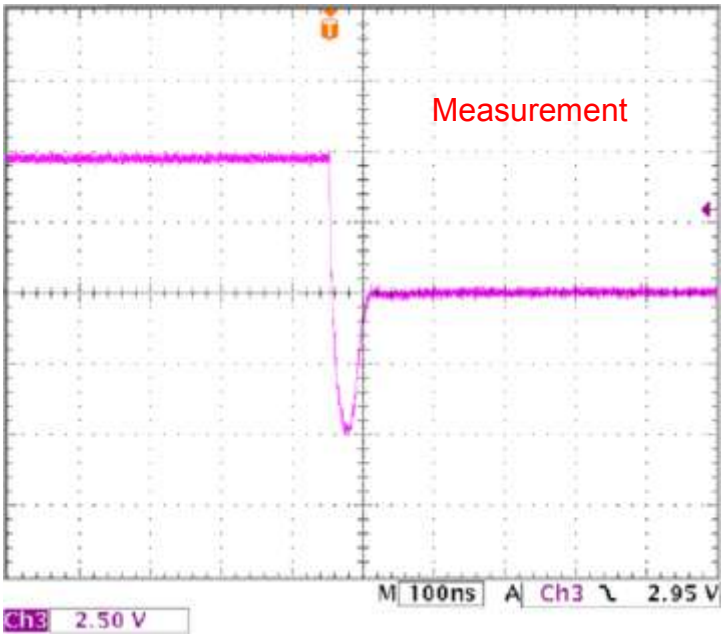
Evaluation Circuit



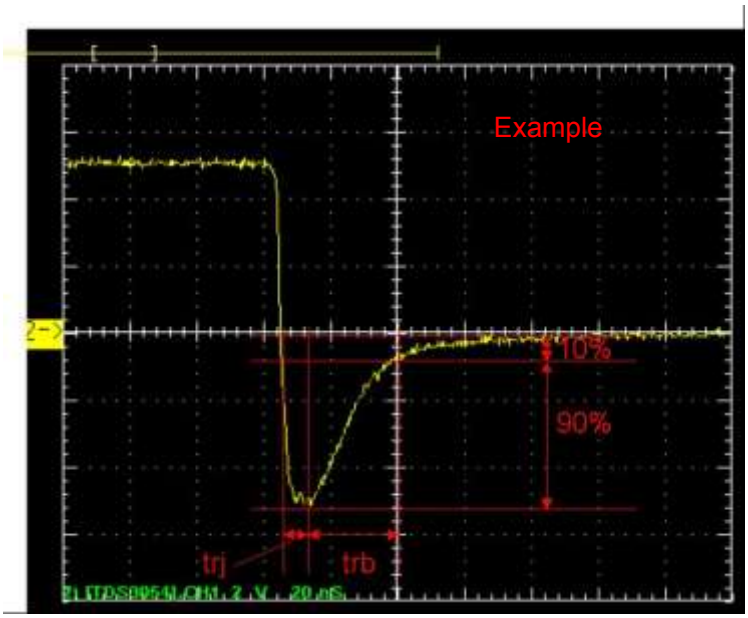
Compare Measurement vs. Simulation

		Measurement	Simulation	Error (%)
trj	**ns**	**18.000**	**18.402**	**2.23**

Reverse Recovery Characteristic Reference



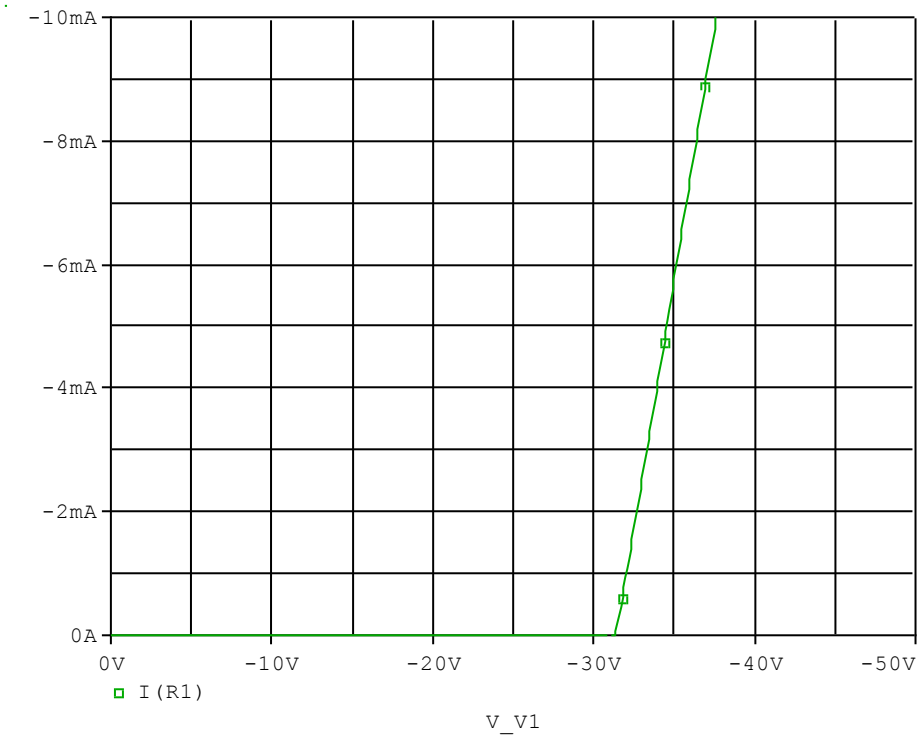
Trj=18.00(ns)
Trb=24.00(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



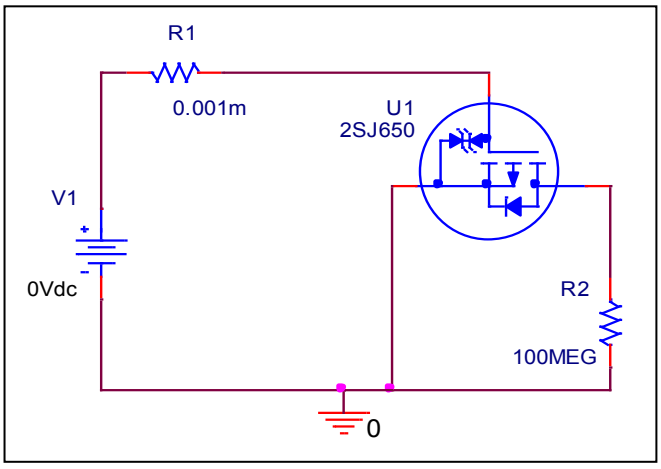
Relation between trj and trb

ESD PROTECTION DIODE SPICE MODEL
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference