Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameters)
PART NUMBER: 2SJ652
MANUFACTURER: SANYO
Body Diode (Model Parameters) / ESD Protection Diode

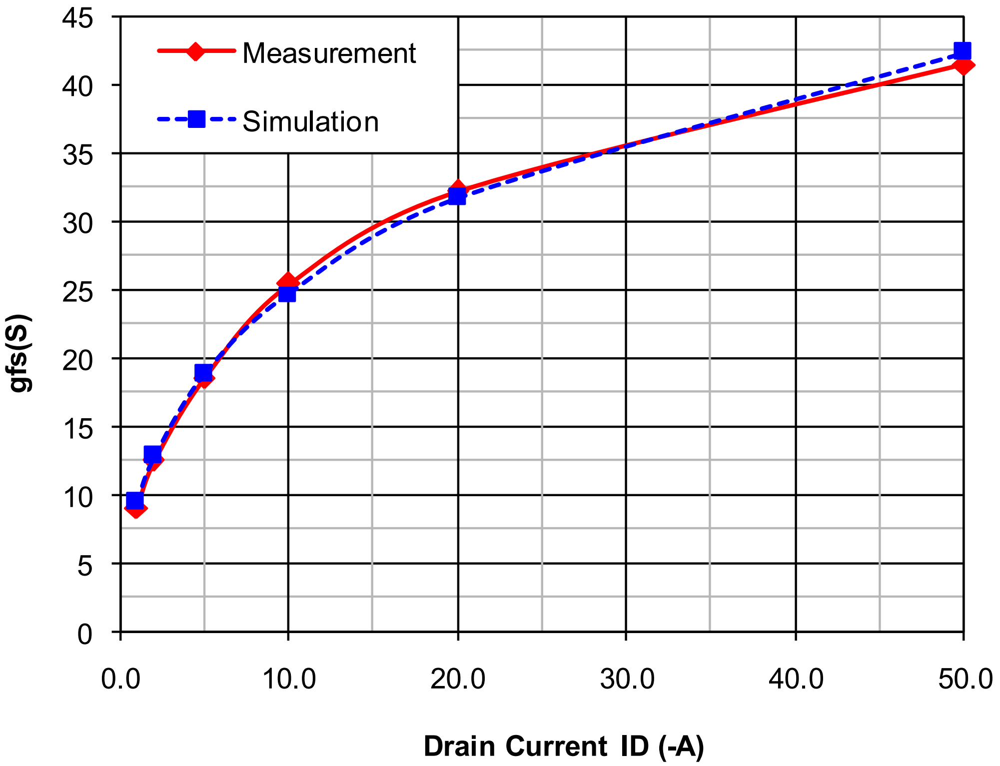
Bee Technologies Inc.

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

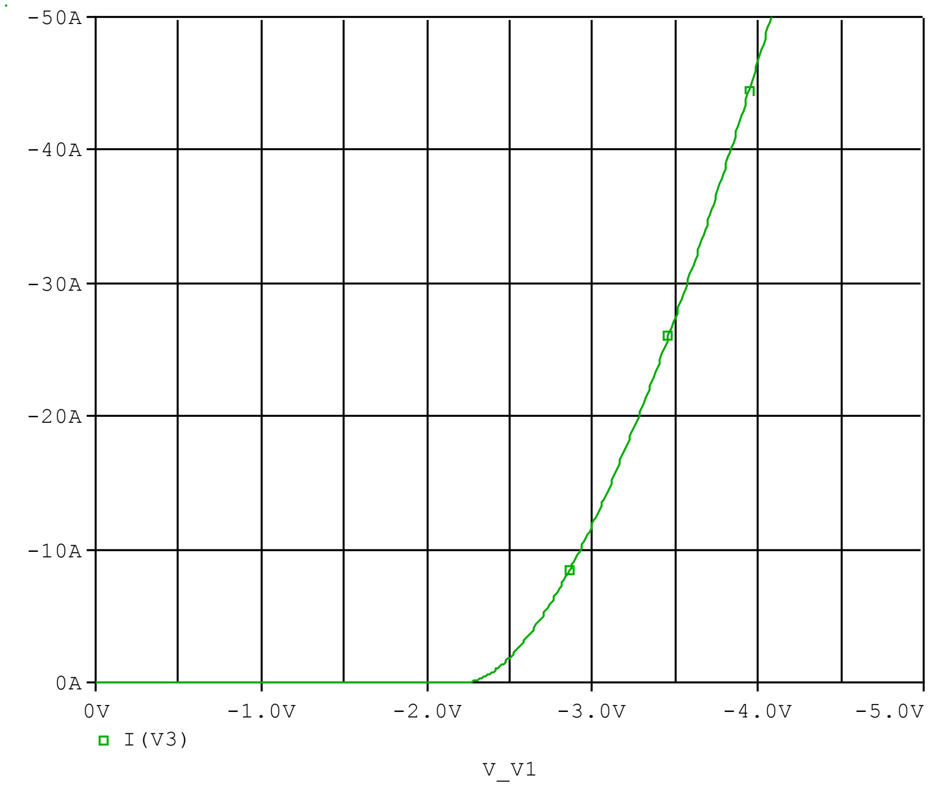


Comparison table

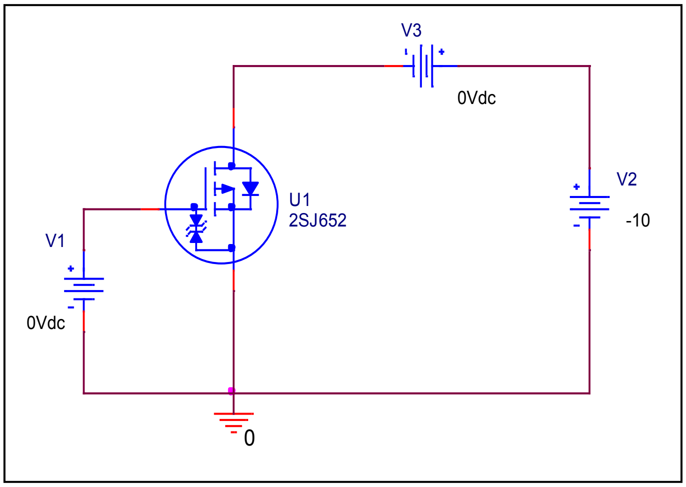
-Id(A)	gfs(S)		Error (%)
	Measurement	Simulation	
1.0000	9.000	9.414	4.60
2.0000	12.500	12.814	2.51
5.0000	18.600	18.857	1.38
10.0000	25.400	24.736	-2.61
20.0000	32.200	31.729	-1.46
50.0000	41.500	42.357	2.07

Vgs-Id Characteristic

Circuit Simulation result

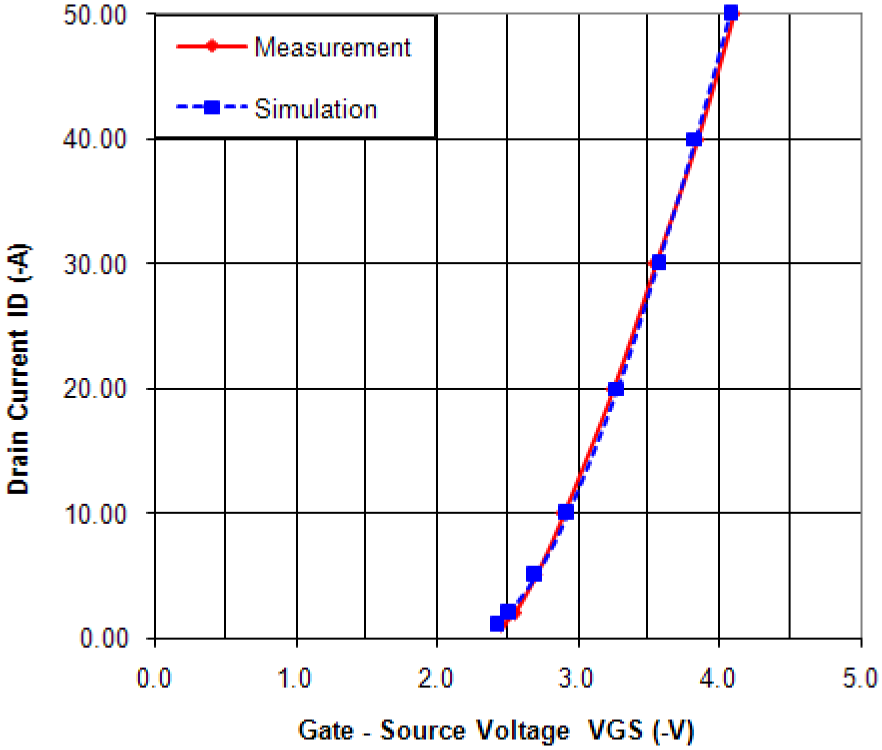


Evaluation circuit



Comparison Graph

Circuit Simulation Result

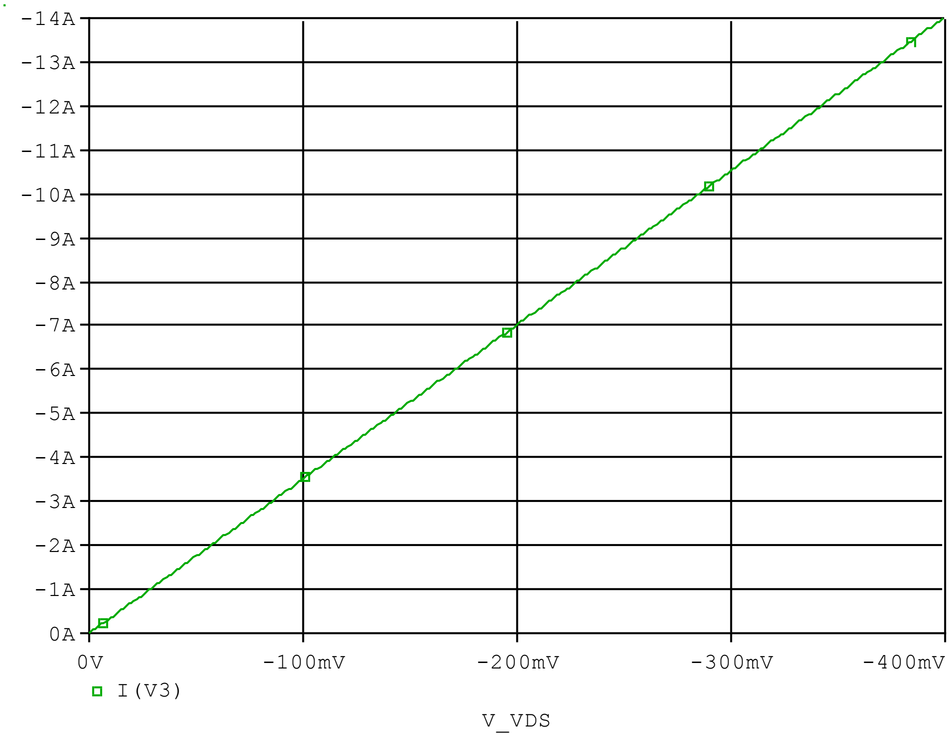


Simulation Result

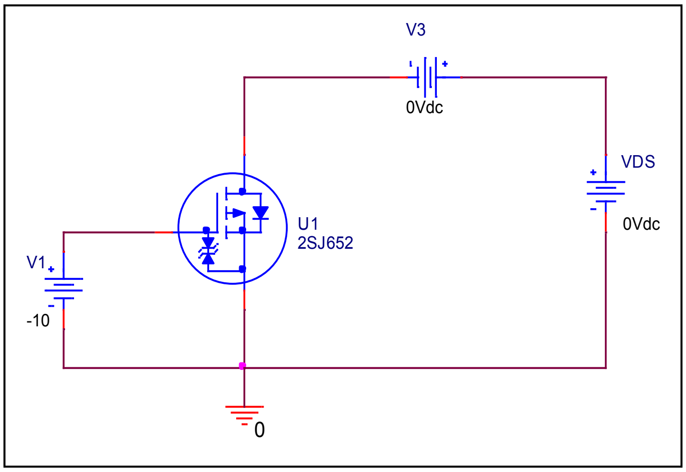
$-I_D$(A)	$-V_{GS}$(V)		Error (%)
	Measurement	Simulation	
1	2.450	2.421	-1.20
2	2.550	2.510	-1.56
5	2.700	2.698	-0.06
10	2.900	2.927	0.92
20	3.250	3.279	0.89
50	4.100	4.079	-0.51

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

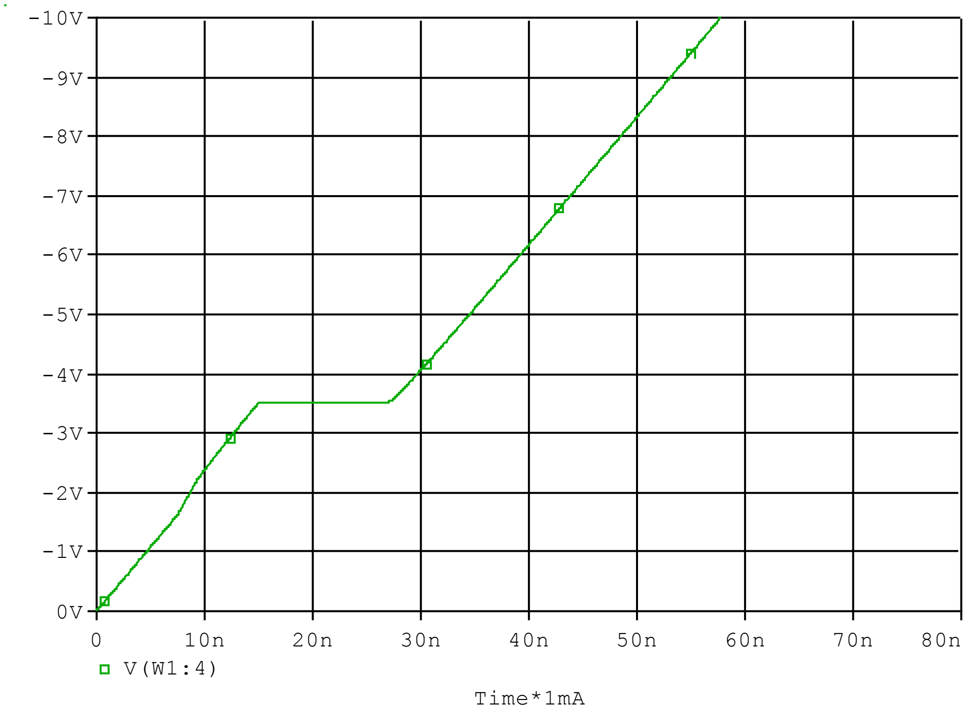


Simulation Result

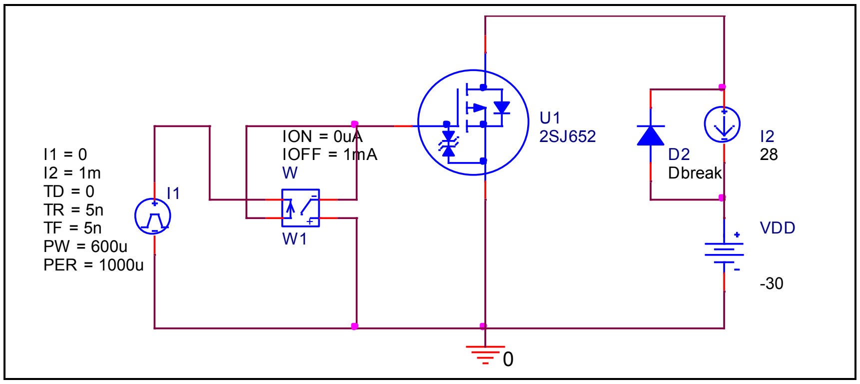
I_D=-14A, V_{GS}=-10V		Measurement	Simulation	Error (%)
R_{DS} (on)	mΩ	28.500	28.500	0.00

Gate Charge Characteristic

Circuit Simulation result



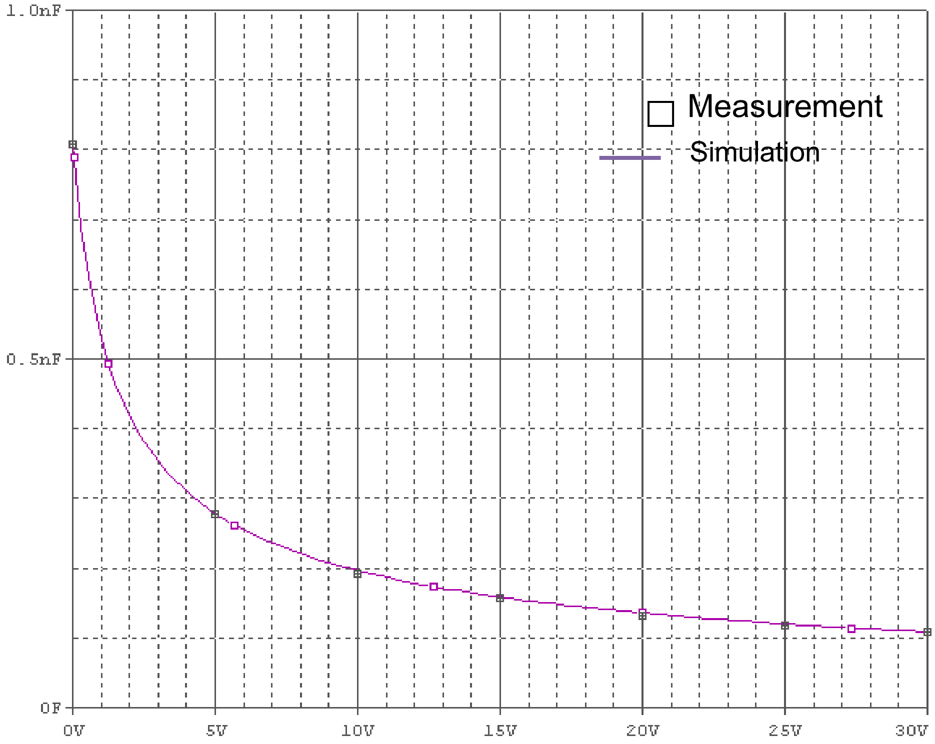
Evaluation circuit



Simulation Result

V_{DD}=-30V,I_D=-28A ,V_{GS}=-10V		Measurement	Simulation	Error (%)
Qgs	nC	15.000	15.035	0.23
Qgd	nC	12.000	11.958	-0.35
Qg	nC	80.000	57.746	-27.82

Capacitance Characteristic

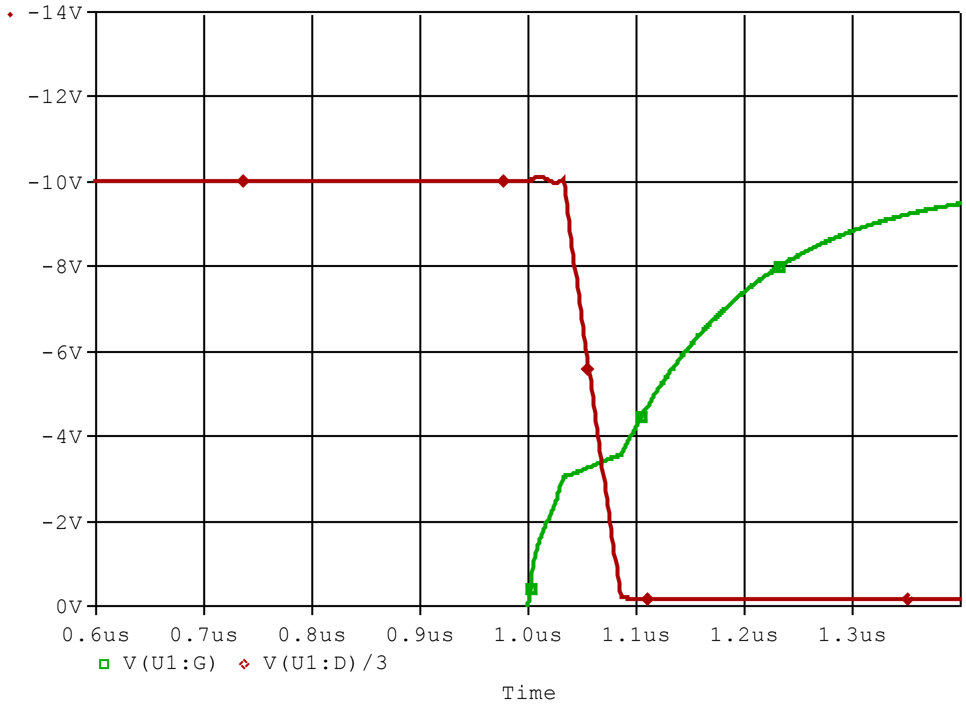


Simulation Result

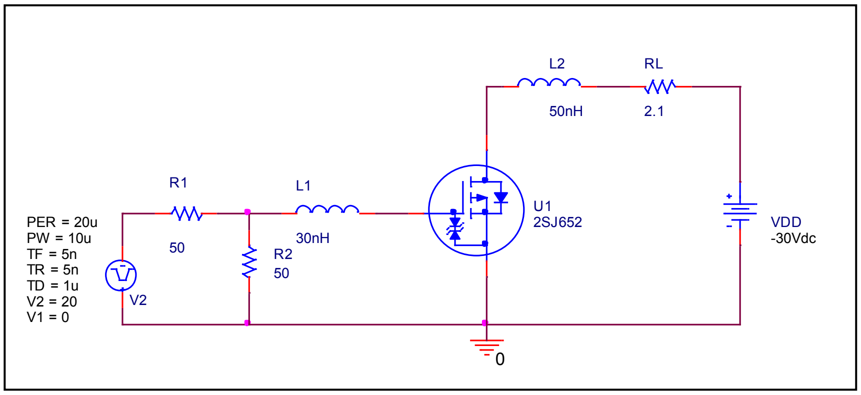
V_{SD}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0	810.000	810.000	0.000
5	280.000	279.250	-0.268
10	195.000	196.900	0.974
15	160.000	158.800	-0.750
20	135.000	135.900	0.667
25	120.000	120.265	0.221
30	110.000	108.755	-1.132

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

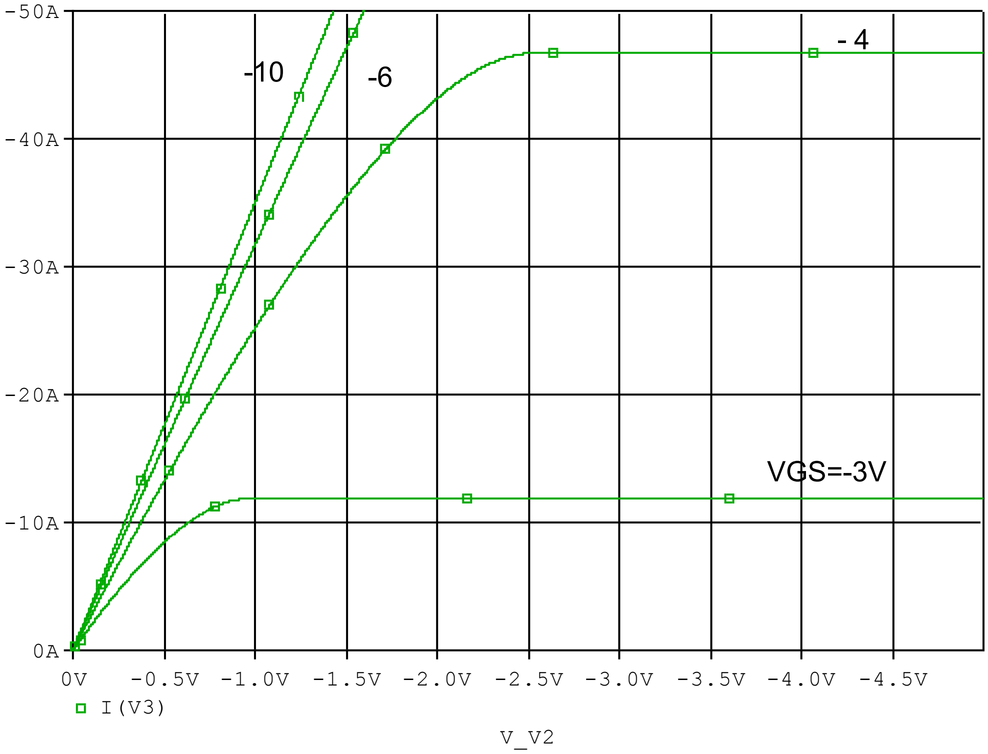


Simulation Result

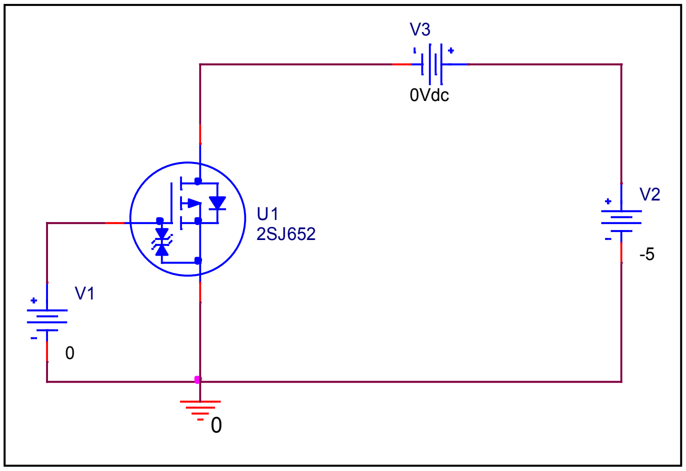
I_D=-14A, V_{DD}=-30V V_{GS}=0/-10V		Measurement	Simulation	Error(%)
td(on)	ns	33.000	33.016	0.05

Output Characteristic

Circuit Simulation result

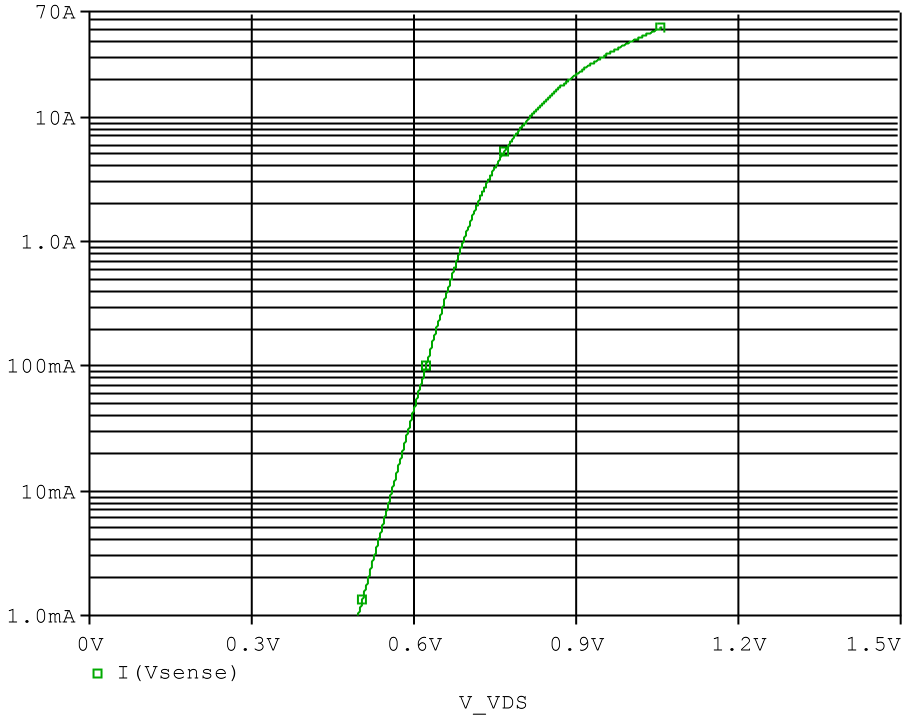


Evaluation circuit

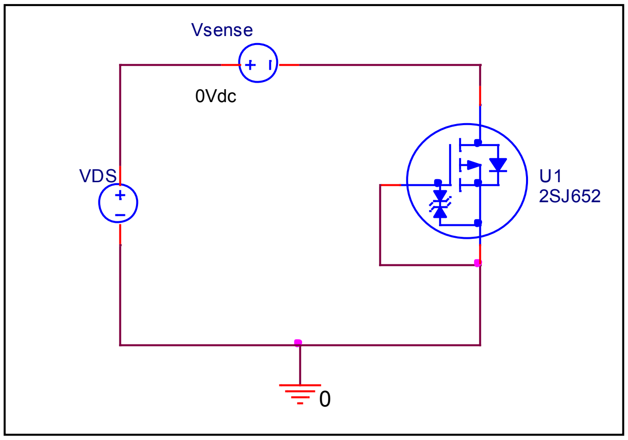


BODY DIODE SPICE MODEL
Forward Current Characteristic

Circuit Simulation Result

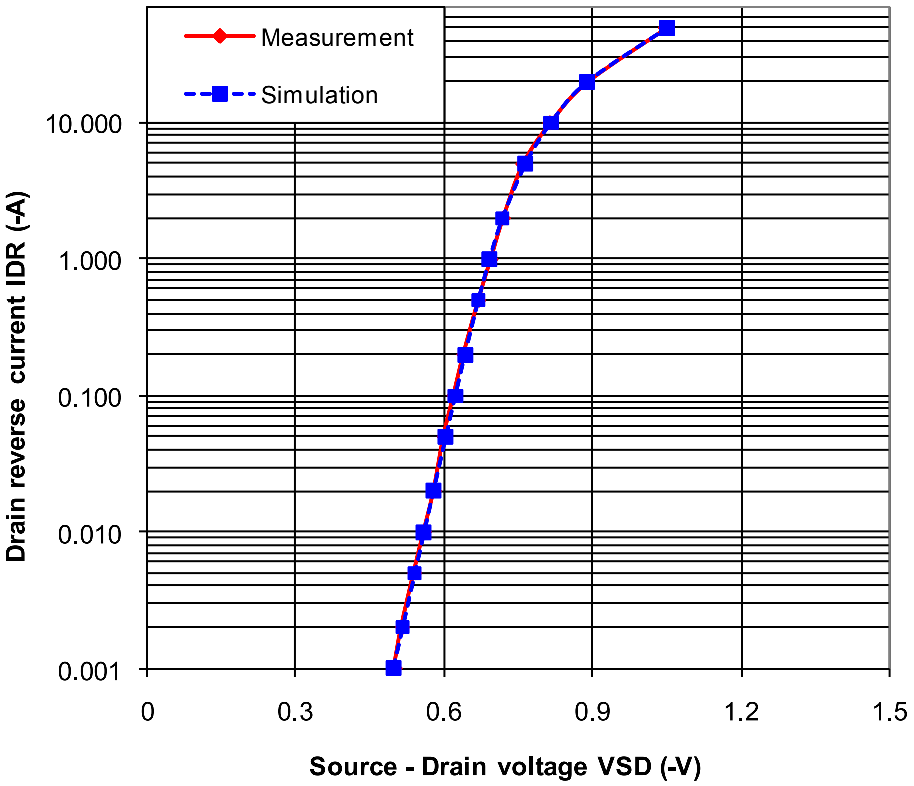


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

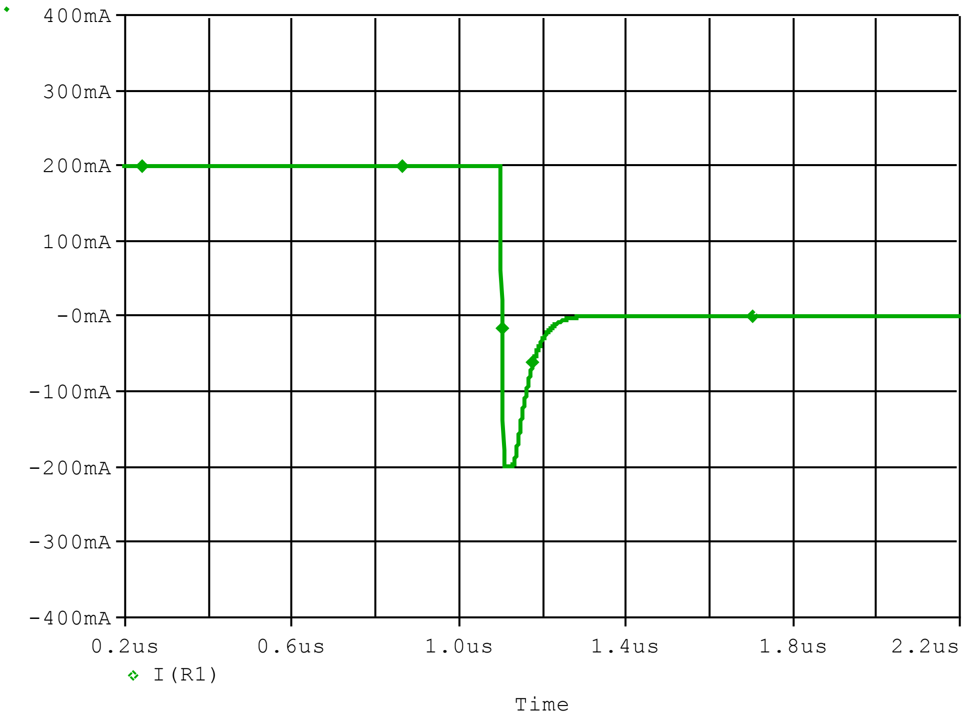


Simulation Result

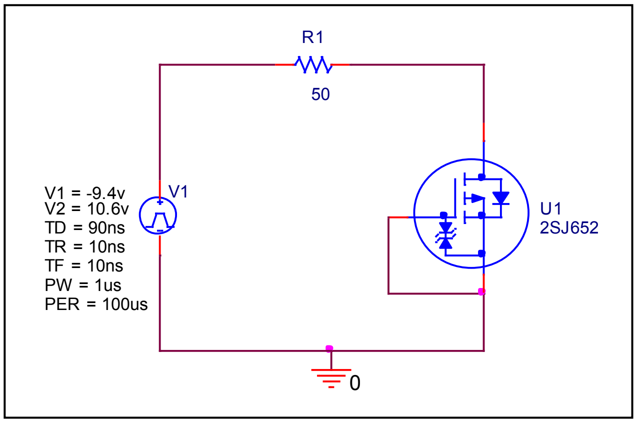
IDR(-A)	VSD(-V)		%Error
	Measurement	Simulation	
0.001	0.5000	0.4973	-0.53
0.01	0.5600	0.5595	-0.08
0.1	0.6200	0.6223	0.38
1	0.6950	0.6913	-0.53
2	0.7200	0.7176	-0.33
5	0.7600	0.7641	0.54
10	0.8150	0.8150	0.00
20	0.8900	0.8882	-0.20
50	1.0500	1.0505	0.05

Reverse Recovery Characteristic

Circuit Simulation Result



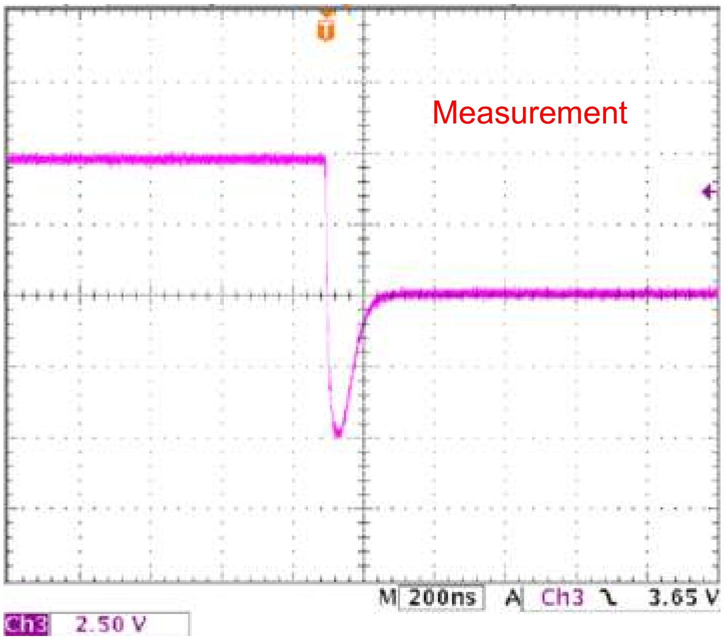
Evaluation Circuit



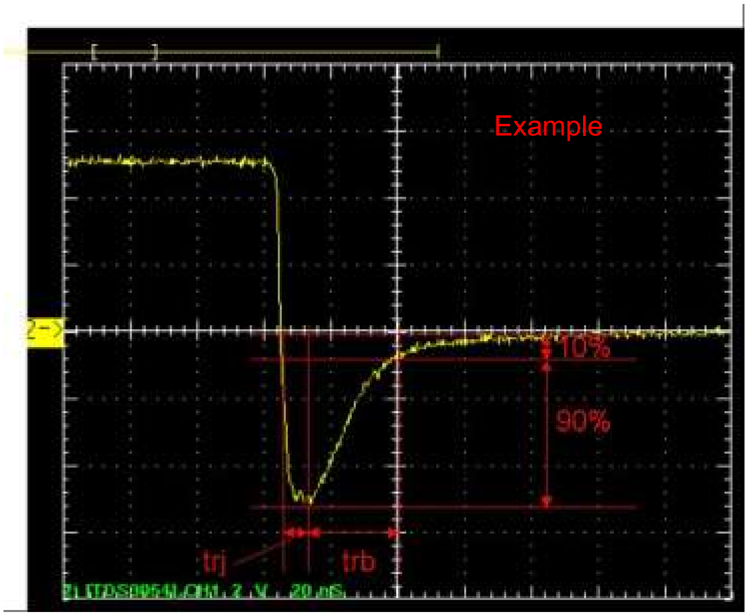
Compare Measurement vs. Simulation

		Measurement	Simulation	Error (%)
trj	**ns**	**28.000**	**27.853**	**-0.52**

Reverse Recovery Characteristic   Reference



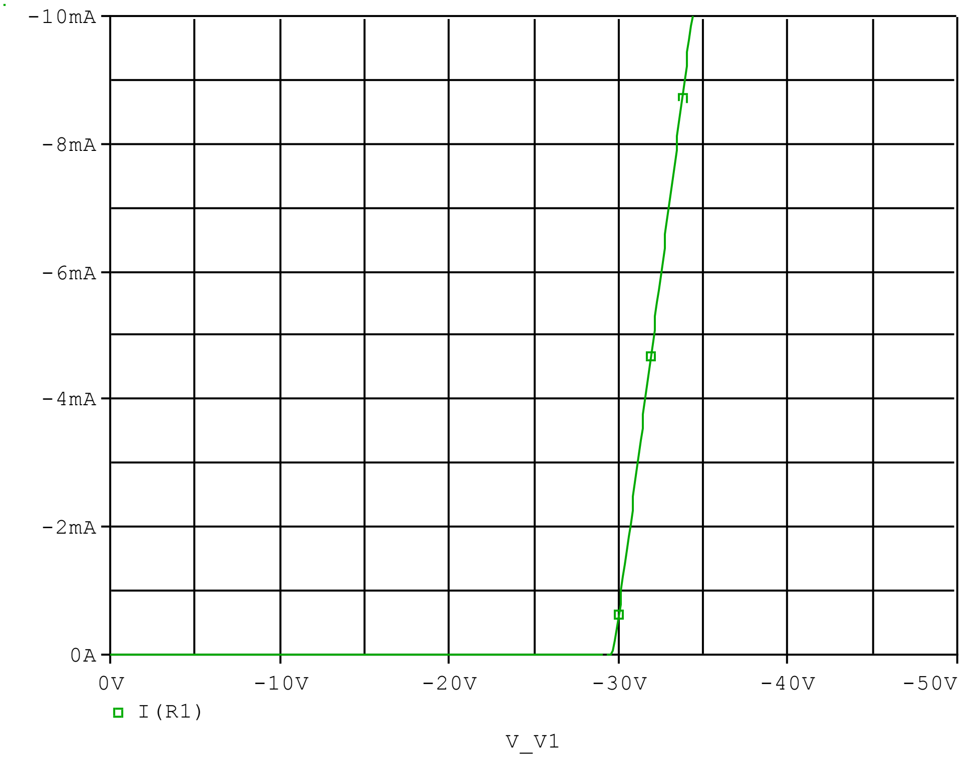
Trj=28.00(ns)
Trb=72.00(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



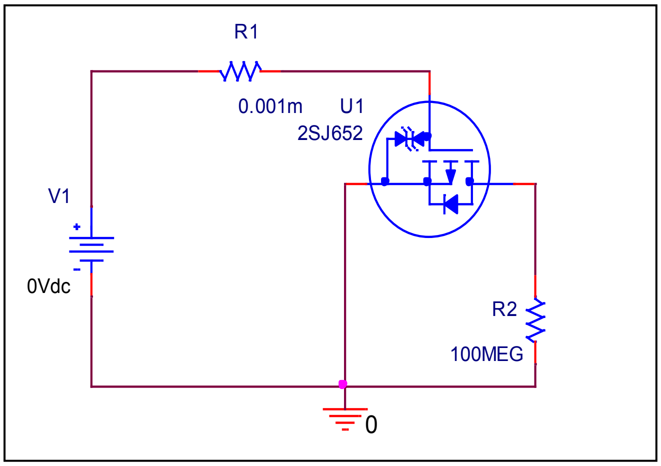
Relation between trj and trb

ESD PROTECTION DIODE SPICE MODEL
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic **Reference**