Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameter)
PART NUMBER: 2SJ448
MANUFACTURER: NEC
Body Diode (Model Parameter) / ESD Protection Diode

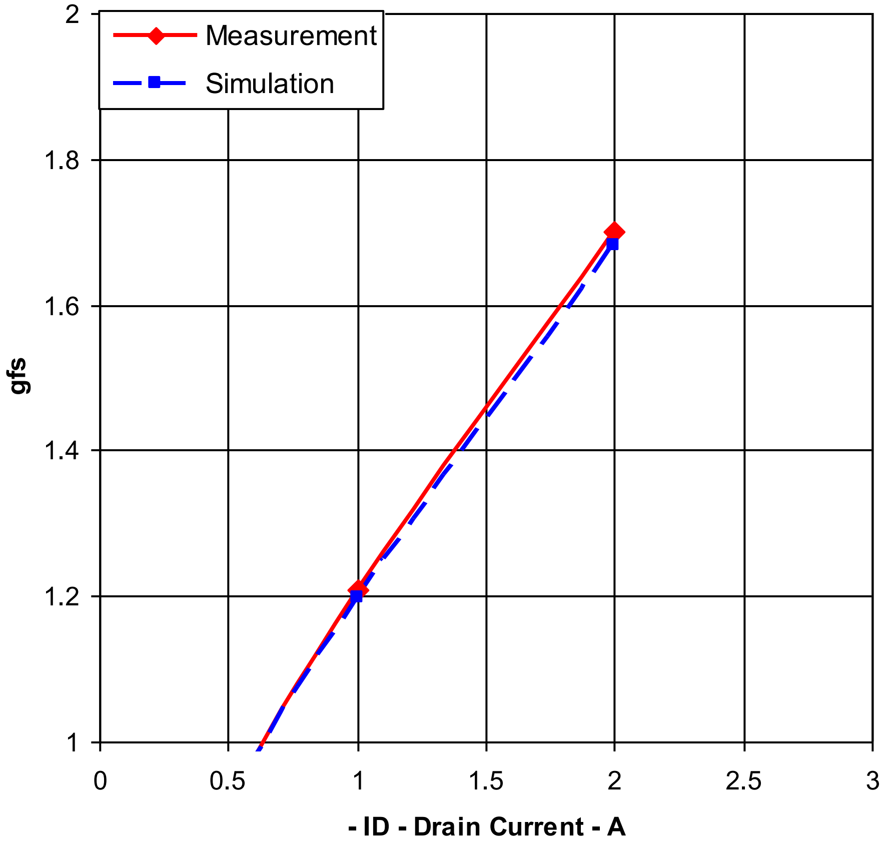
Bee Technologies Inc.

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

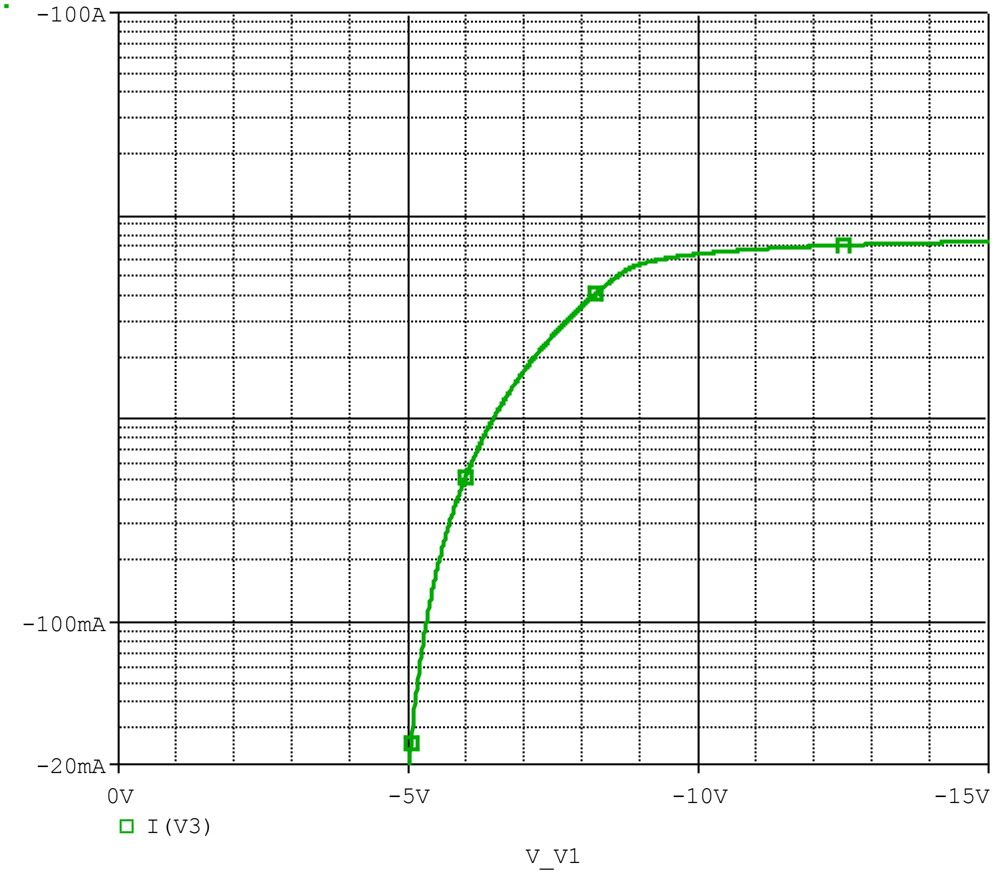


Comparison table

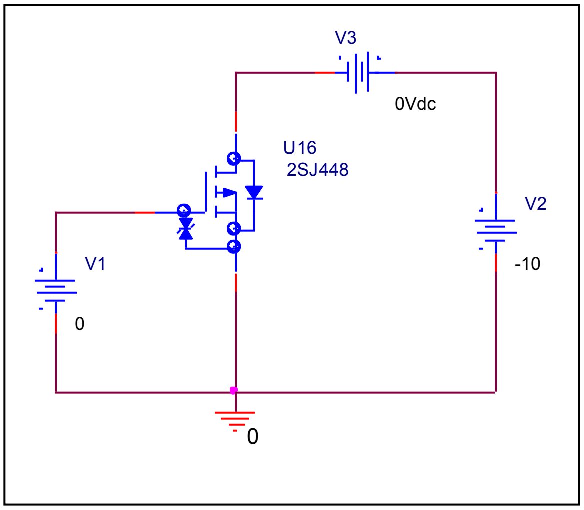
Id(A)	gfs		Error(%)
	Measurement	Simulation	
-0.100	0.400	0.385	-3.750
-0.200	0.570	0.548	-3.947
-0.500	0.900	0.900	0.000
-1.000	1.210	1.197	-1.074
-2.000	1.700	1.680	-1.176

Vgs-Id Characteristic

Circuit Simulation result

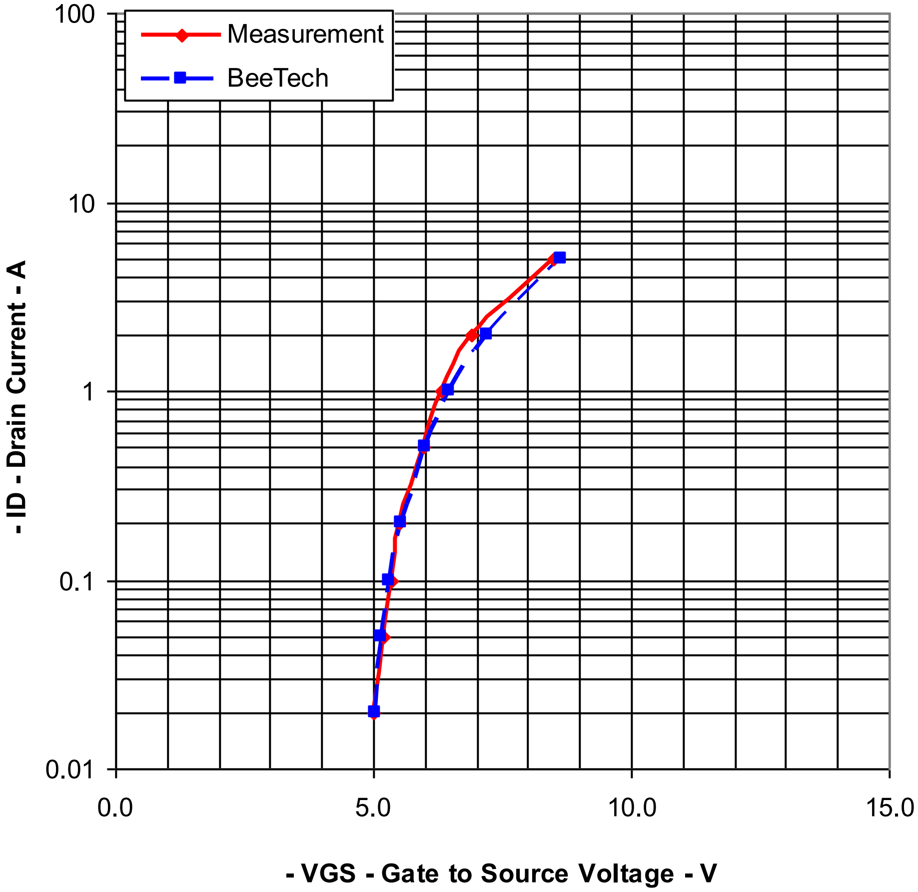


Evaluation circuit



Comparison Graph

Circuit Simulation Result

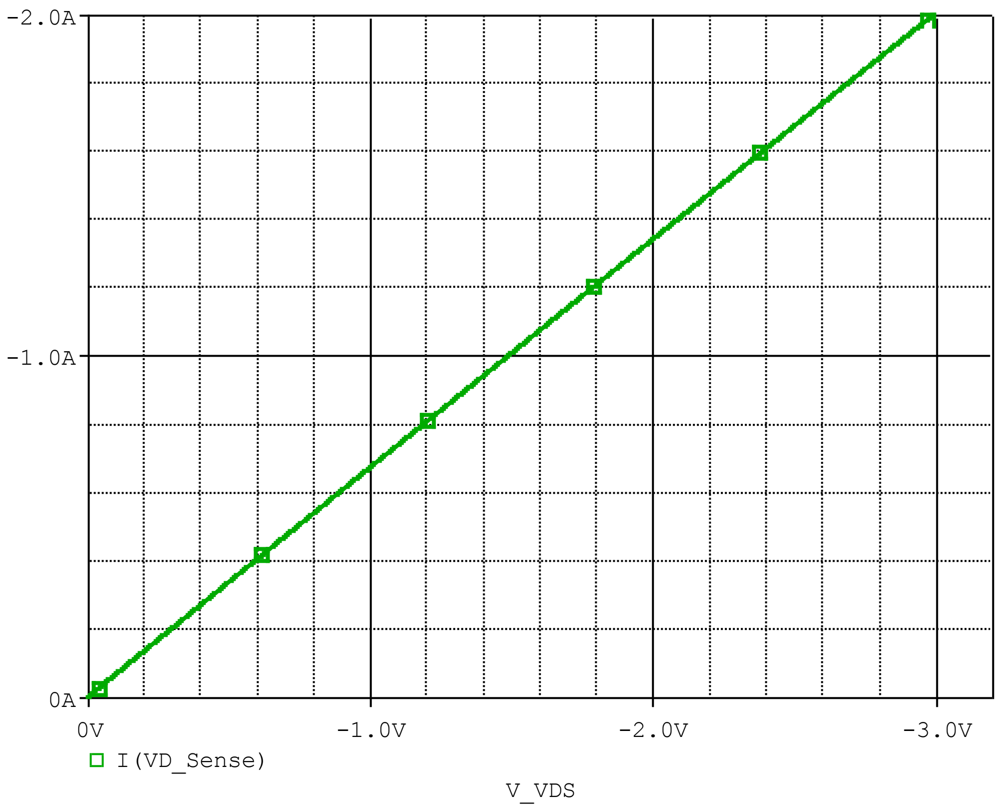


Simulation Result

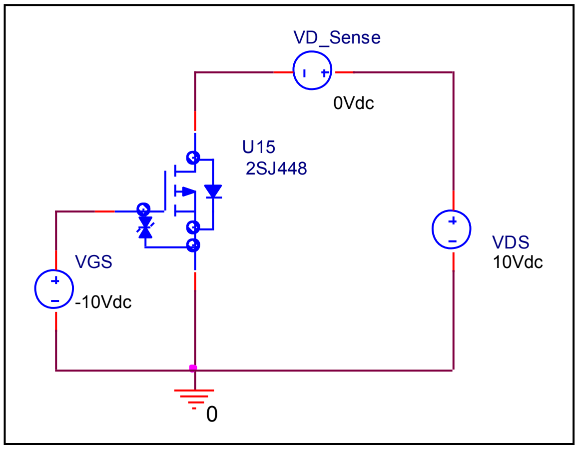
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.020	5.000	5.035	0.696
0.050	5.200	5.172	-0.535
0.100	5.350	5.328	-0.419
0.200	5.500	5.548	0.873
0.500	5.950	5.993	0.726
1.000	6.300	6.489	3.006
2.000	6.900	7.194	4.264
5.000	8.500	8.630	1.533

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

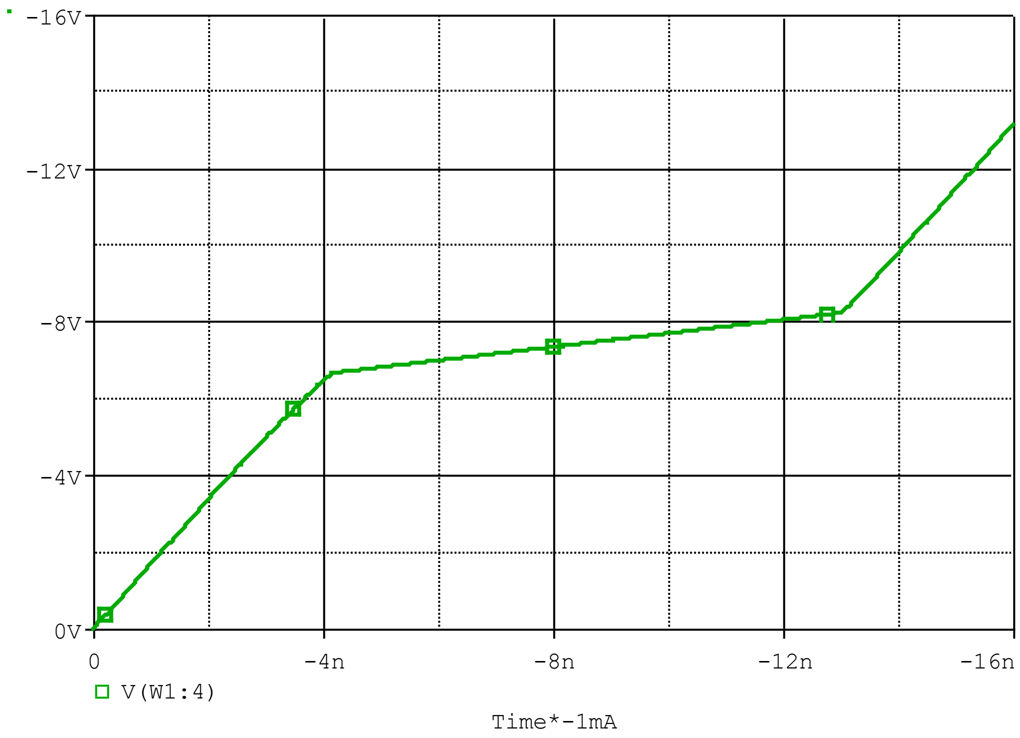


Simulation Result

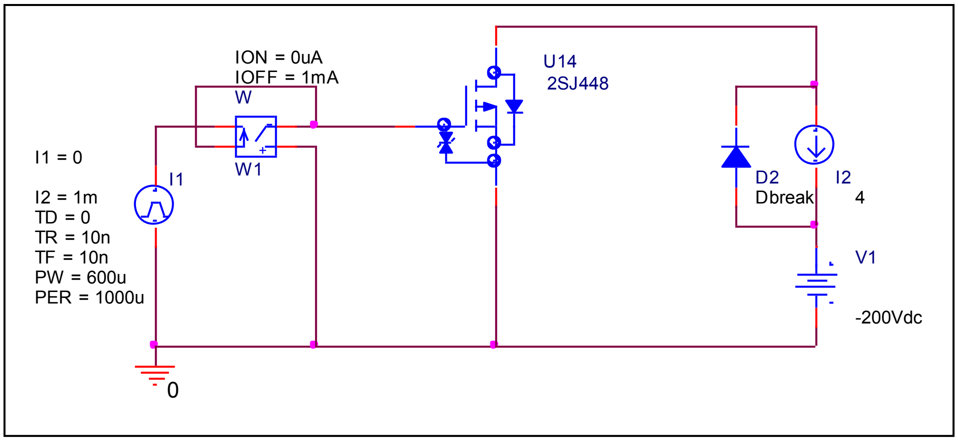
I_D=-2.0A, V_{GS}=-10V	Measurement	Simulation	Error (%)
R_{DS} (on) Ω	1.500	1.500	0.000

Gate Charge Characteristic

Circuit Simulation result



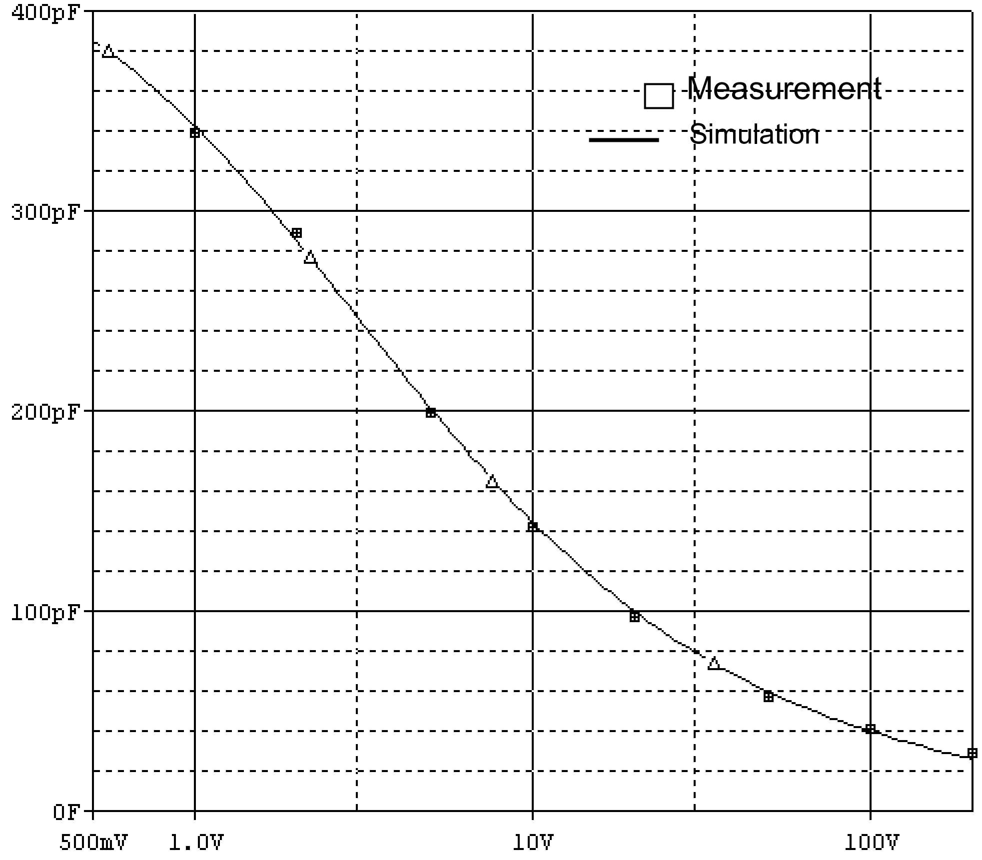
Evaluation circuit



Simulation Result

V_{DD}=-200V,I_D=2.0A ,V_{GS}=-10V	**Measurement**	**Simulation**	**Error (%)**
Qgs (nC)	**4.000**	**4.140**	**3.500**
Qgd(nC)	**9.000**	**8.859**	**-1.567**
Qg(nC)	**15.000**	**14.127**	**-5.820**

Capacitance Characteristic

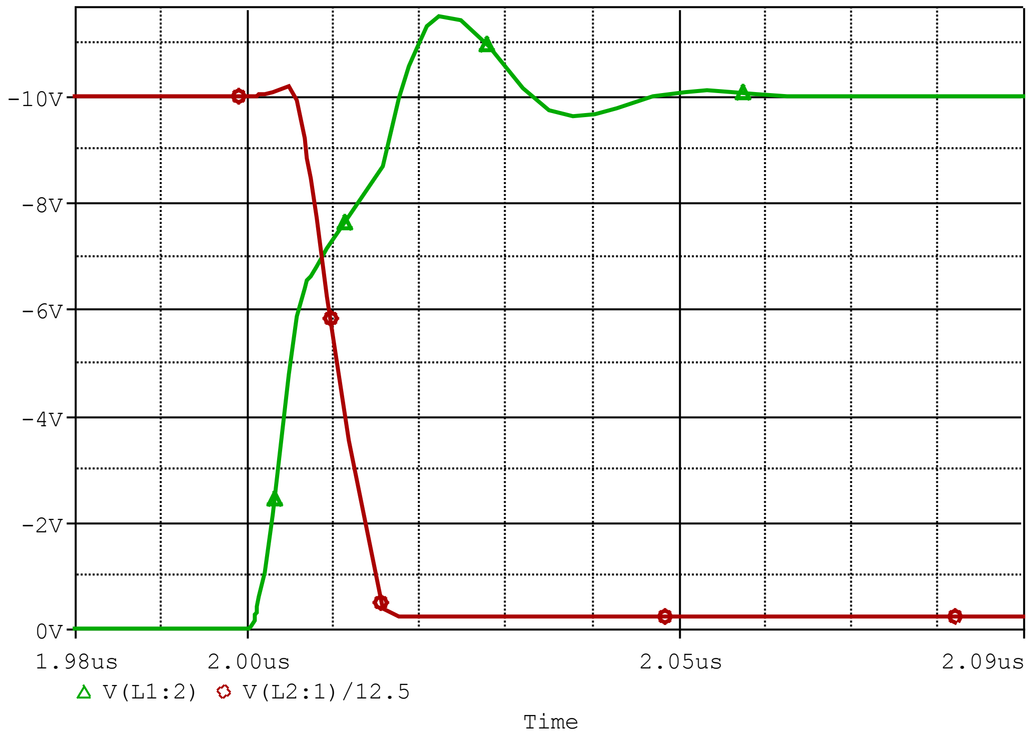


Simulation Result

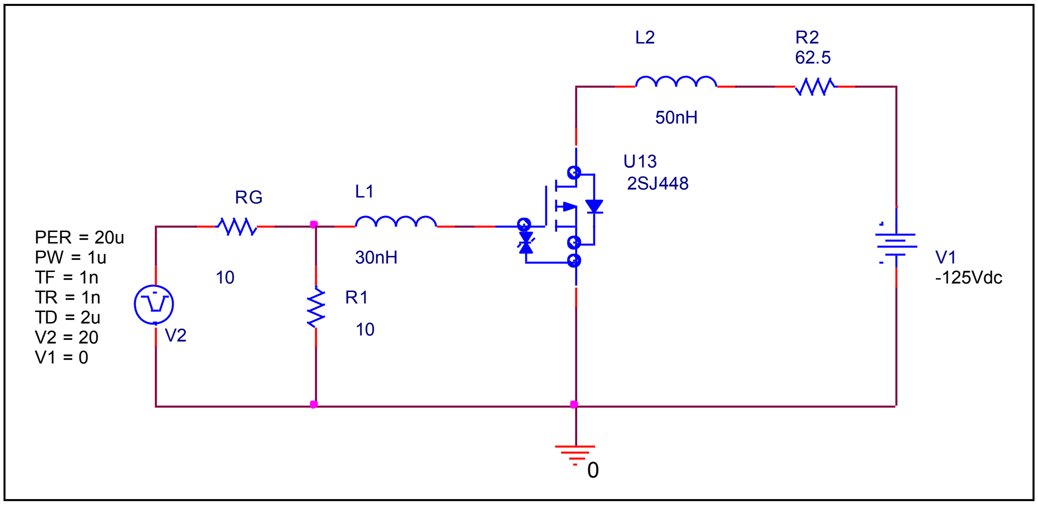
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
1.000	340.000	350.000	2.941
2.000	290.000	285.000	-1.724
5.000	200.000	200.000	0.000
10.000	143.000	144.000	0.699
20.000	98.000	100.000	2.041
50.000	58.000	60.000	3.448
100.000	42.000	42.000	0.000
200.000	30.000	29.000	-3.333

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

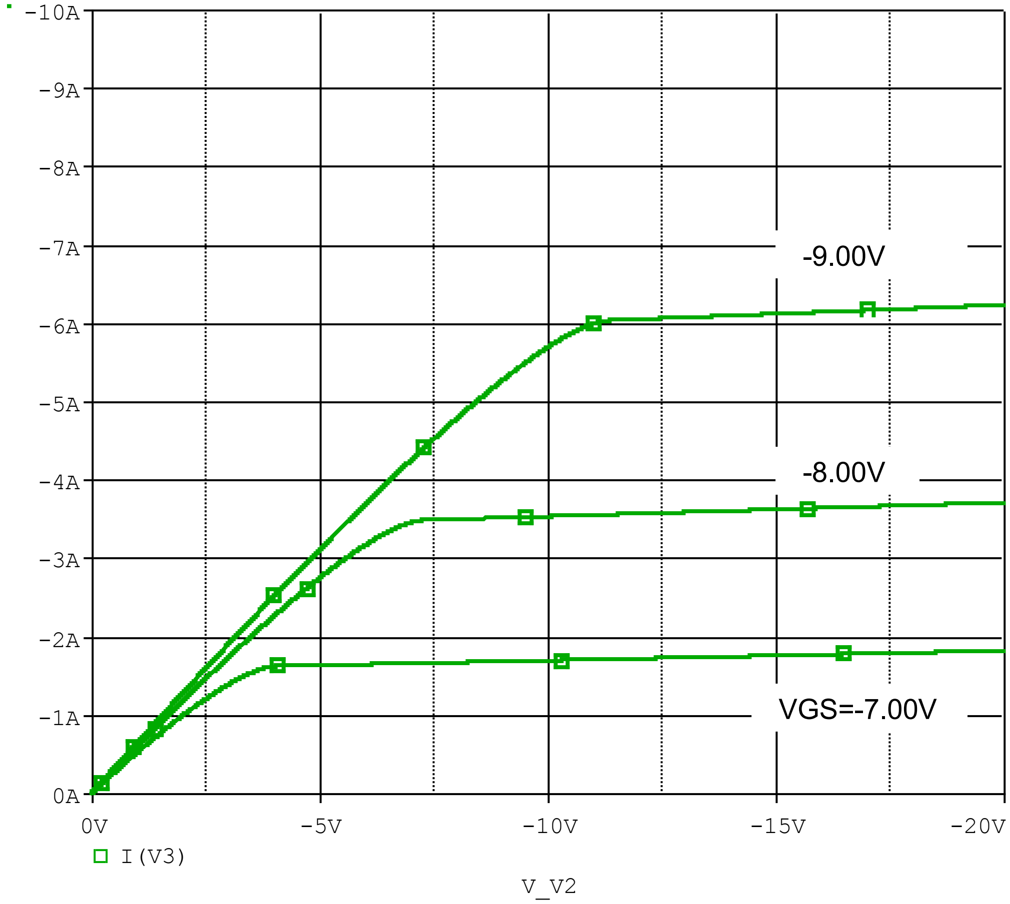


Simulation Result

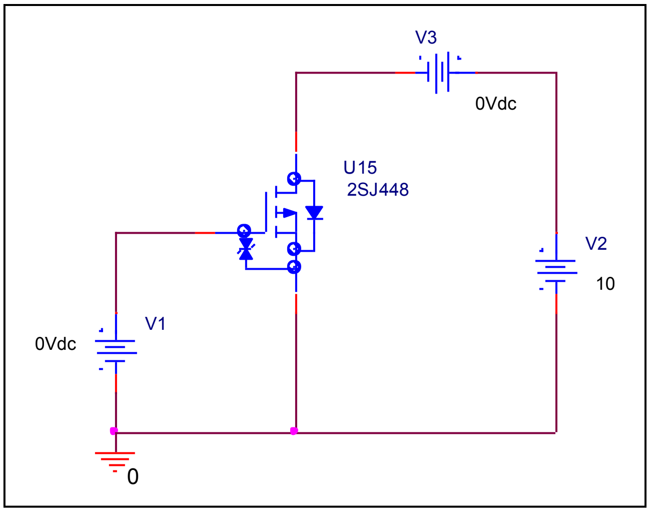
I_D=-10A, V_{DD}=-125V V_{GS}=0/-10V	Measurement	Simulation	Error(%)
Ton(ns)	13.000	13.025	0.192

Output Characteristic

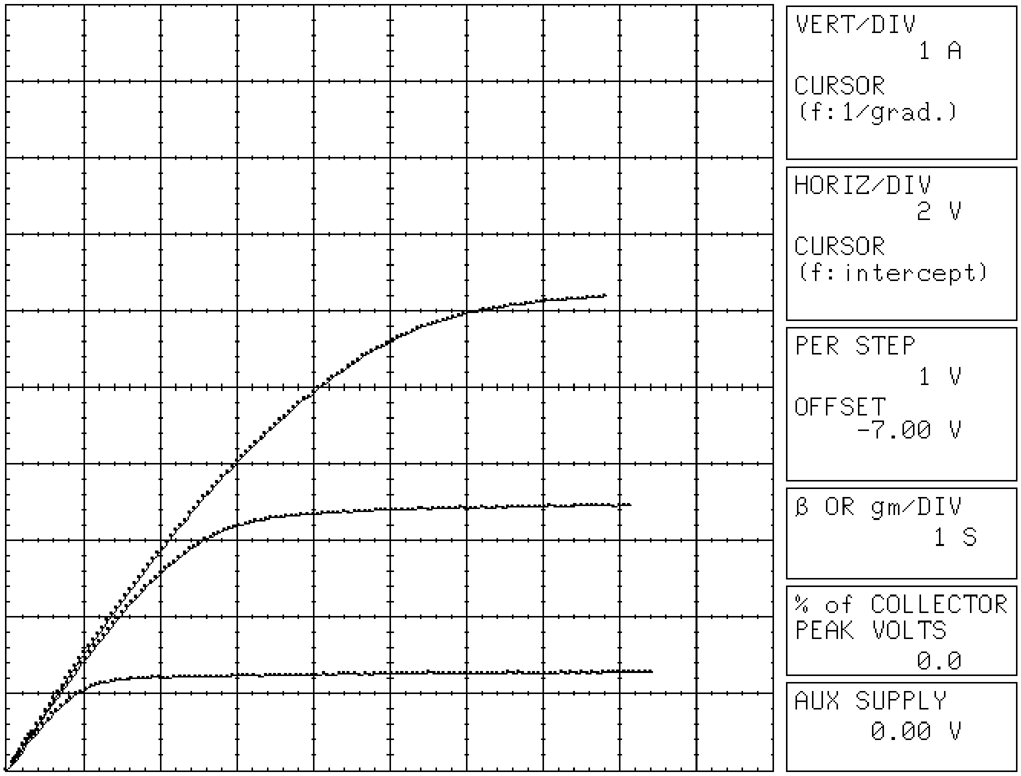
Circuit Simulation result



Evaluation circuit



Output Characteristic Reference



VERT/DIV
1 A
CURSOR
(f:1/grad.)

HORIZ/DIV
2 V
CURSOR
(f:intercept)

PER STEP
1 V
OFFSET
-7.00 V

ß OR gm/DIV
1 S

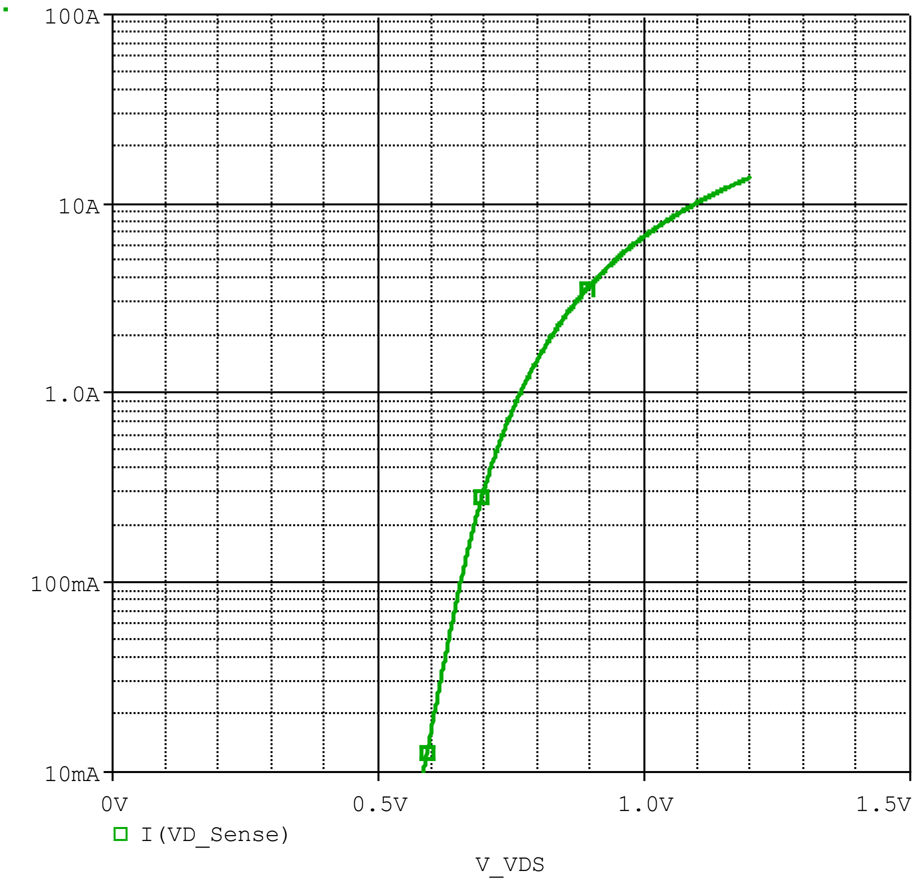
% of COLLECTOR
PEAK VOLTS
0.0

AUX SUPPLY
0.00 V

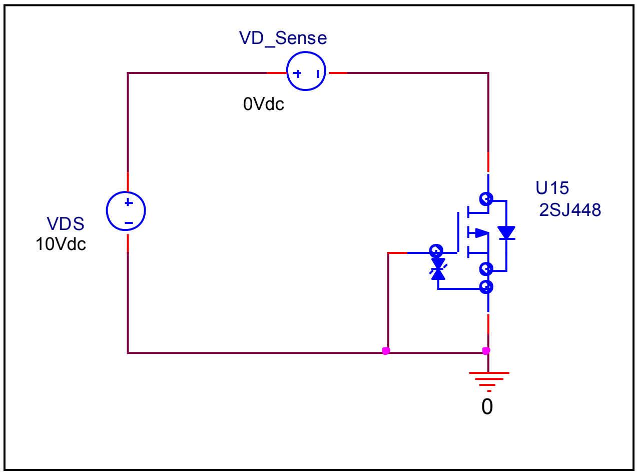
BODY DIODE SPICE MODEL

Forward Current Characteristic

Circuit Simulation Result

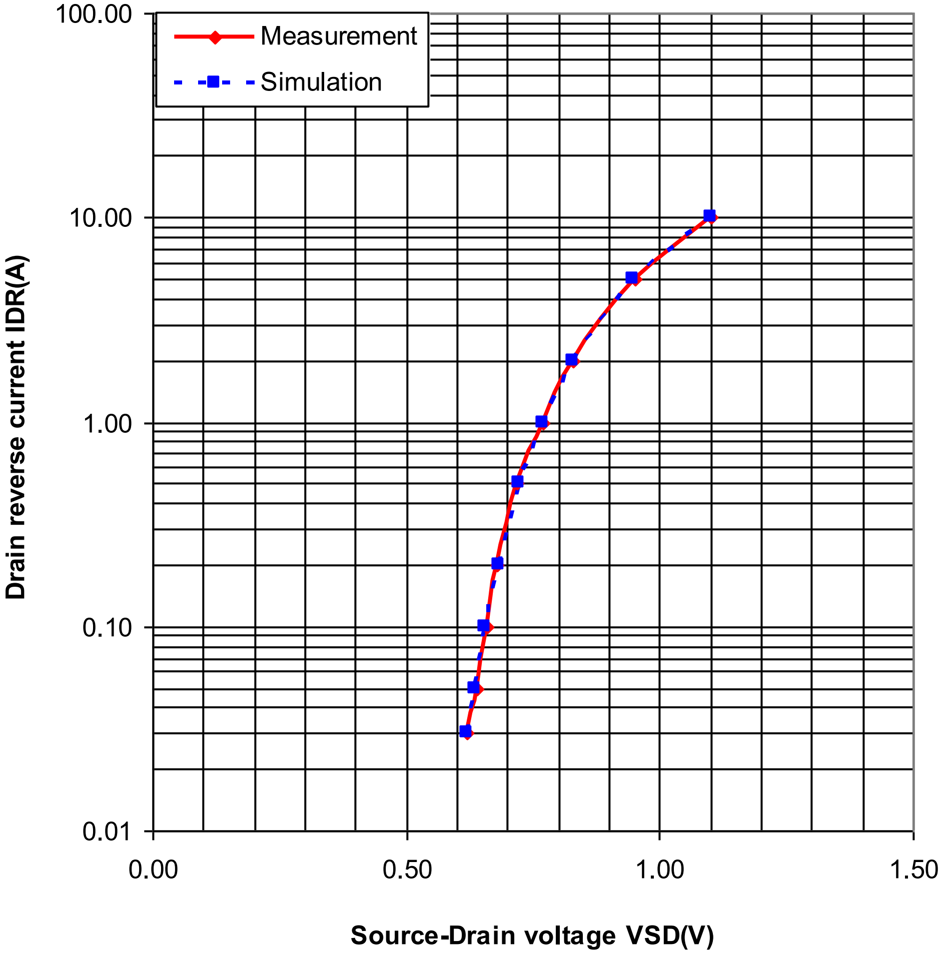


Evaluation Circuit



ComparisonGraph

Circuit Simulation Result

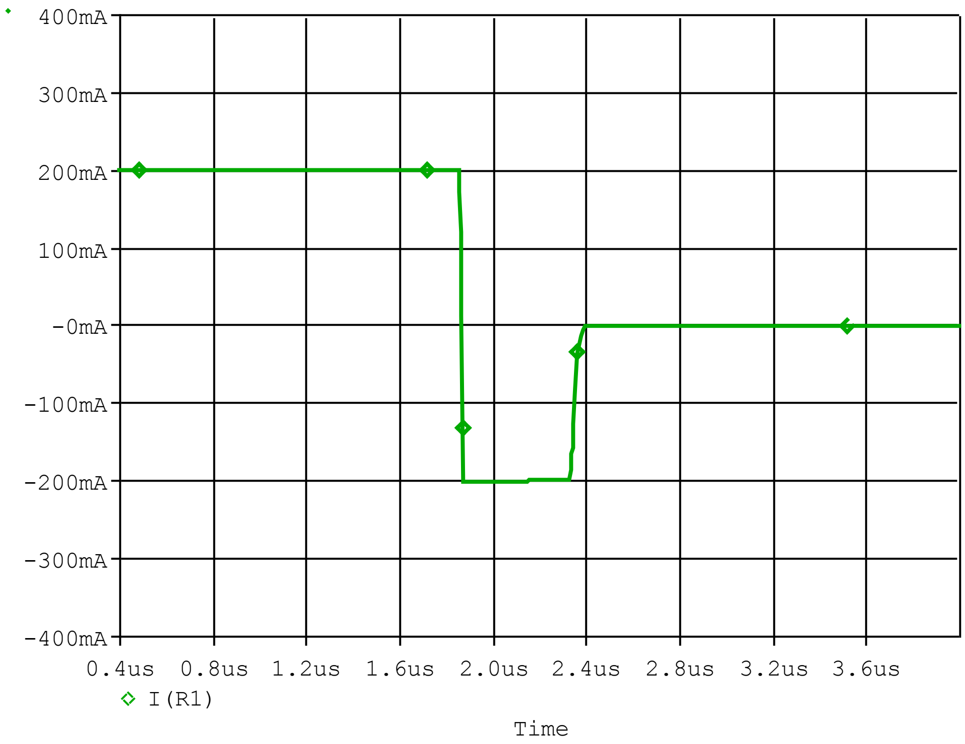


Simulation Result

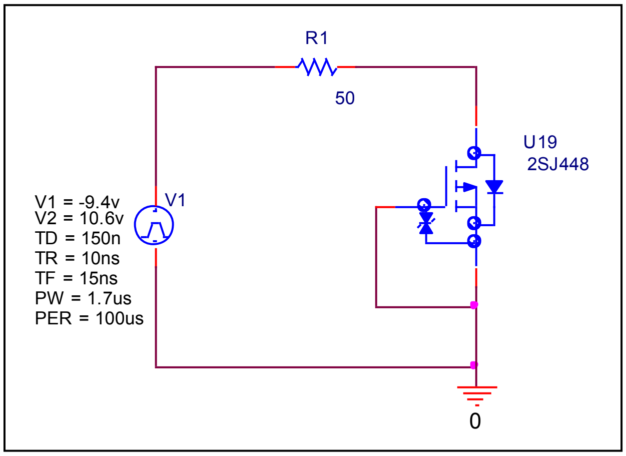
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.030	0.620	0.619	-0.161
0.050	0.640	0.634	-0.938
0.100	0.660	0.656	-0.606
0.200	0.680	0.682	0.294
0.500	0.720	0.724	0.556
1.000	0.770	0.769	-0.130
2.000	0.830	0.829	-0.120
5.000	0.950	0.948	-0.211
10.000	1.100	1.102	0.182

Reverse Recovery Characteristic

Circuit Simulation Result



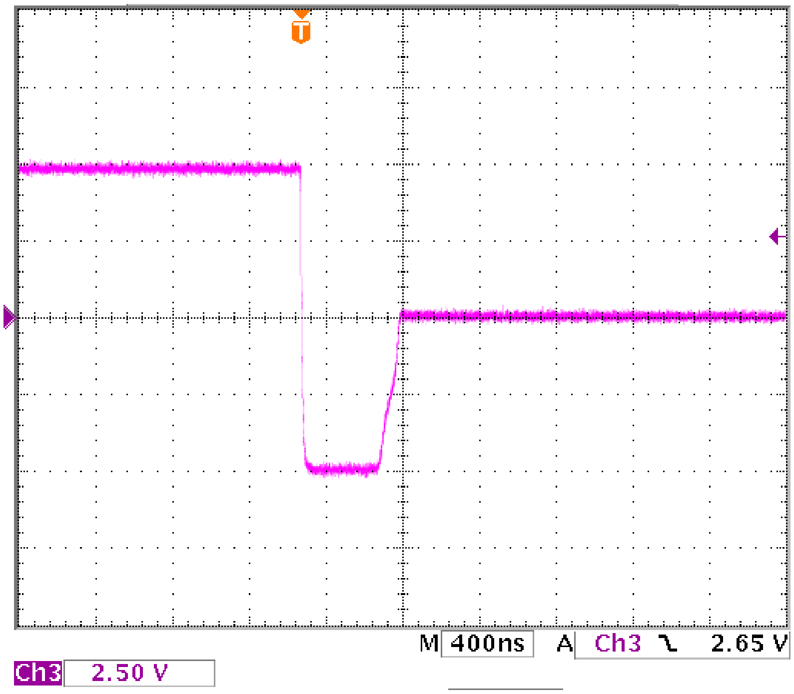
Evaluation Circuit



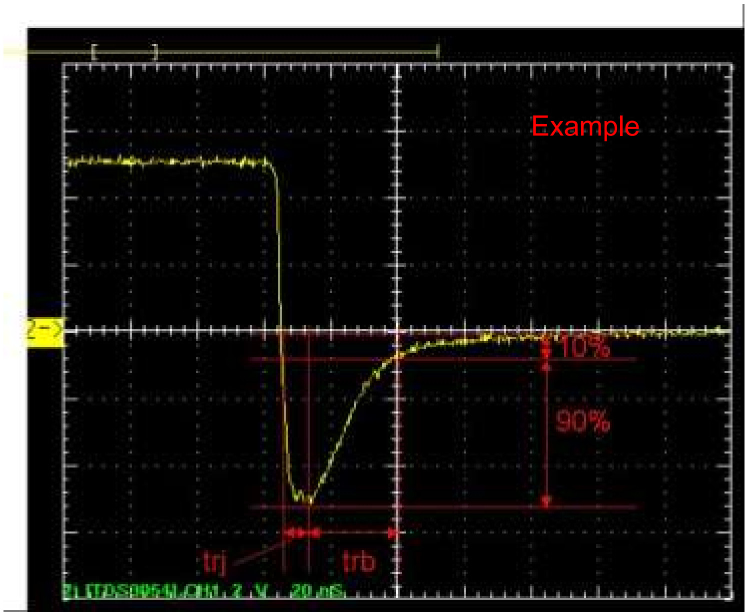
Compare Measurement vs. Simulation

Trr(ns)	Measurement	Simulation	Error (%)
Trj+Trb	504.000	505.165	0.231

Reverse Recovery Characteristic



Trj=392.00(ns)
Trb=112.00(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50

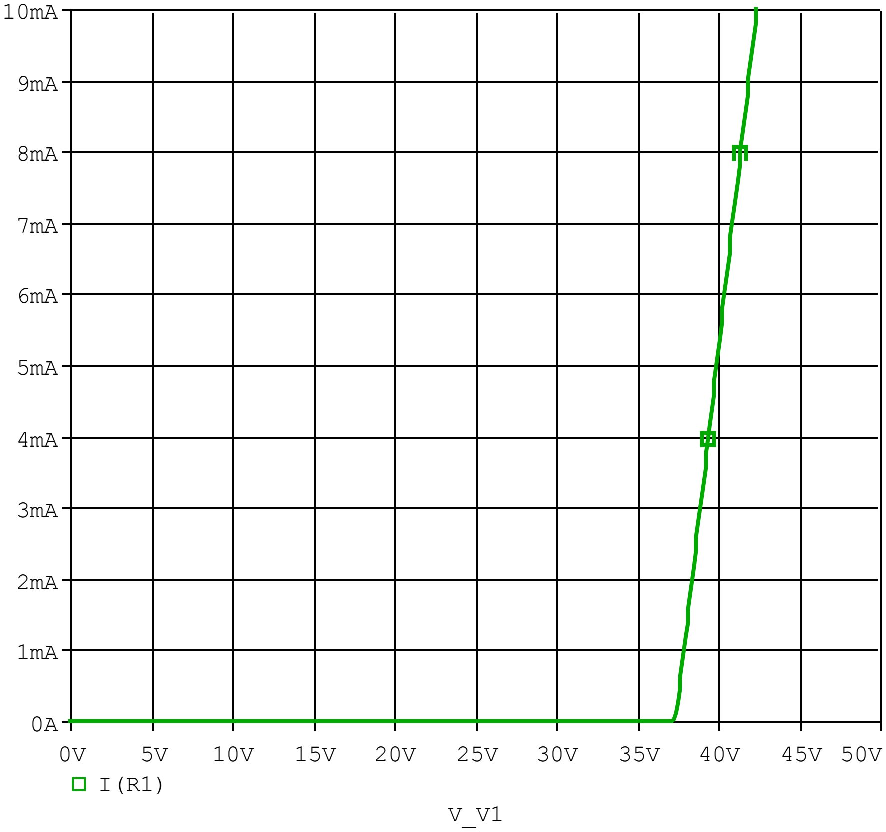


Relation between trj and trb

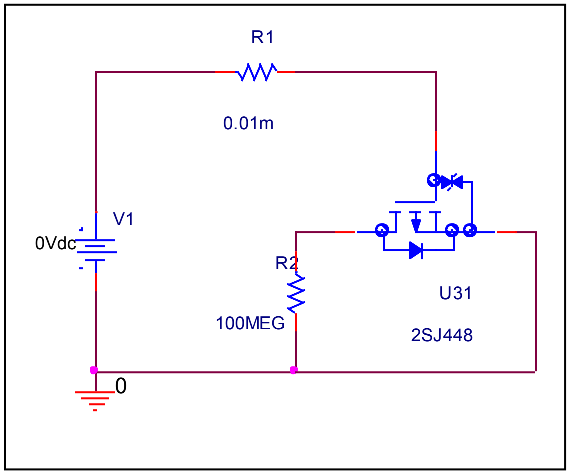
ESD PROTECTION DIODE SPICE MODEL

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



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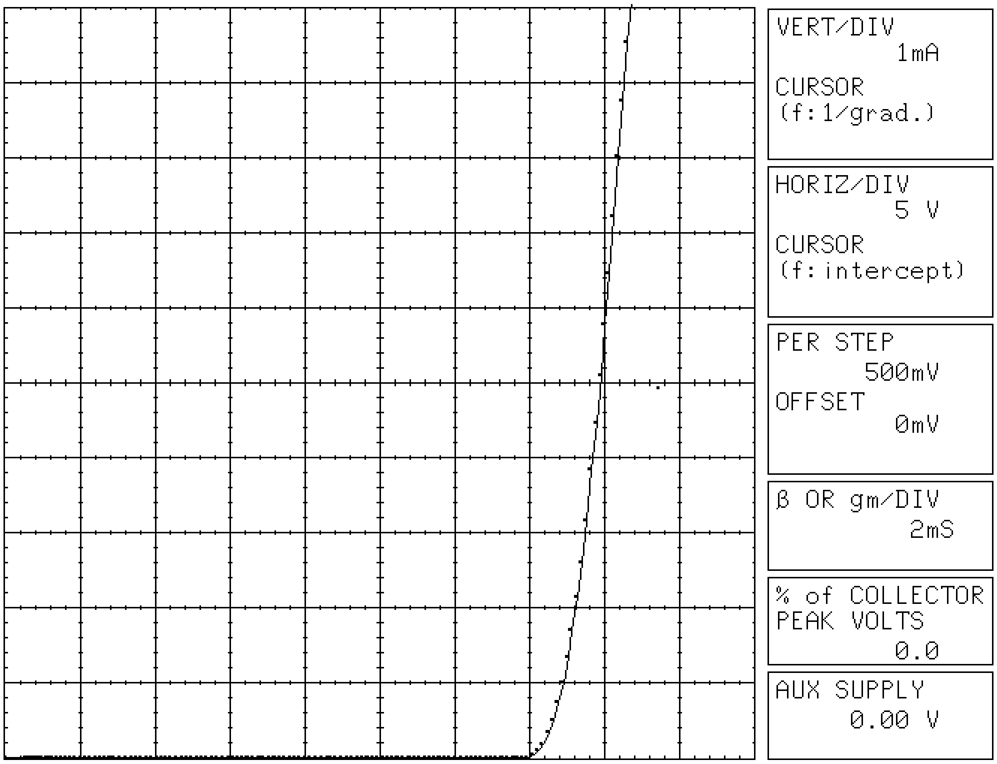
Zener Voltage Characteristic **Reference**



VERT/DIV 1mA

CURSOR (f:1/grad.)

HORIZ/DIV 5 V

CURSOR (f:intercept)

PER STEP 500mV

OFFSET 0mV

β OR gm/DIV 2mS

% of COLLECTOR PEAK VOLTS 0.0

AUX SUPPLY 0.00 V