Device Modeling Report

COMPONENTS: MOSFET (Professional Model)
PART NUMBER: 2SK3703
MANUFACTURER: SANYO
REMARK: Body Diode (Professional Model) /
ESD Protection Diode

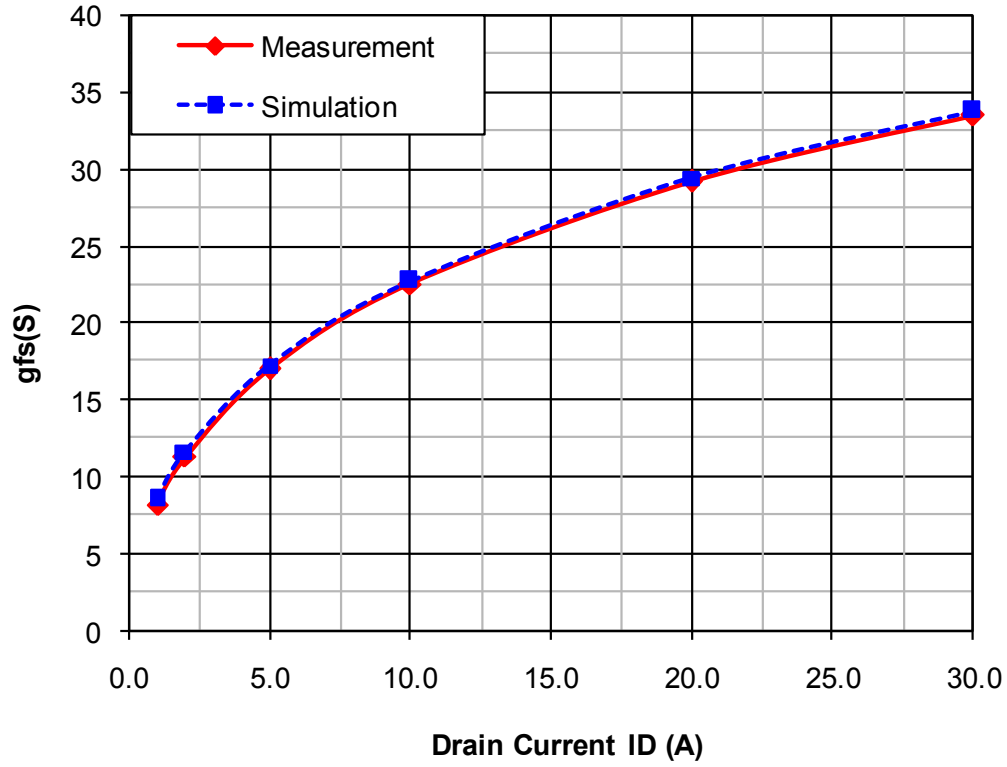
Bee Technologies Inc.

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

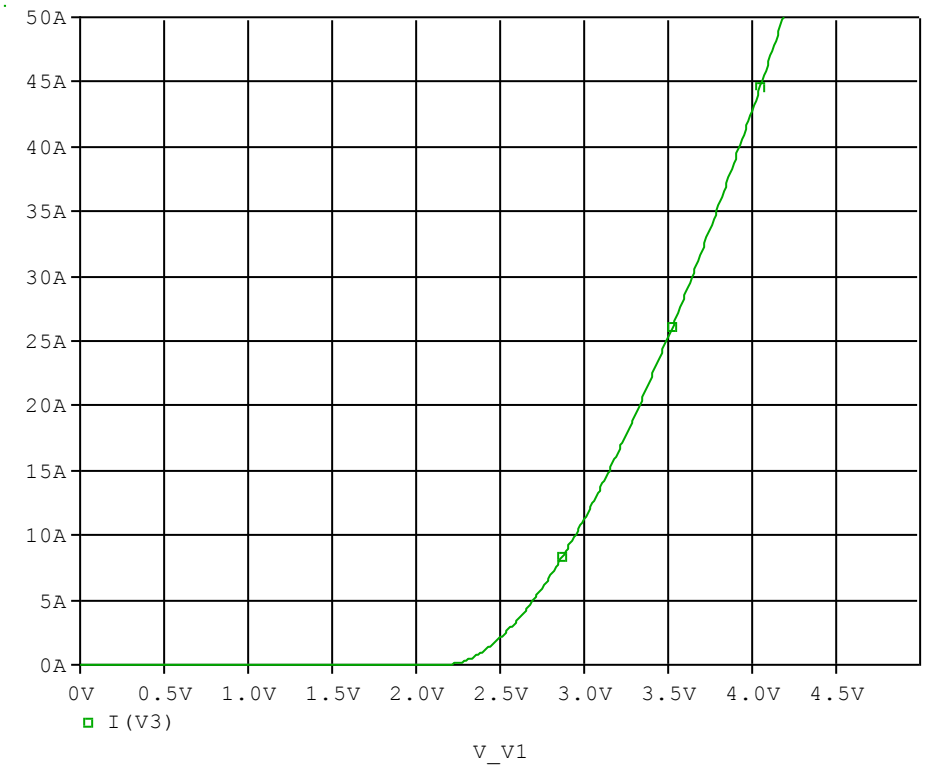


Comparison table

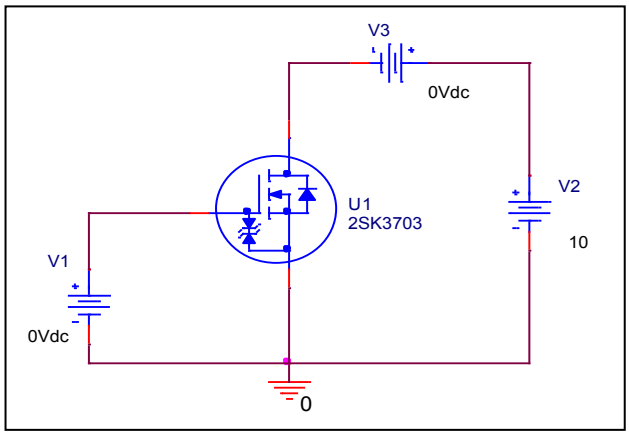
Id(A)	gfs(S)		Error (%)
	Measurement	Simulation	
1	8.200	8.518	3.87
2	11.300	11.638	2.99
5	17.000	17.238	1.40
10	22.500	22.755	1.13
20	29.200	29.408	0.71
30	33.500	33.785	0.85

Vgs-Id Characteristic

Circuit Simulation result

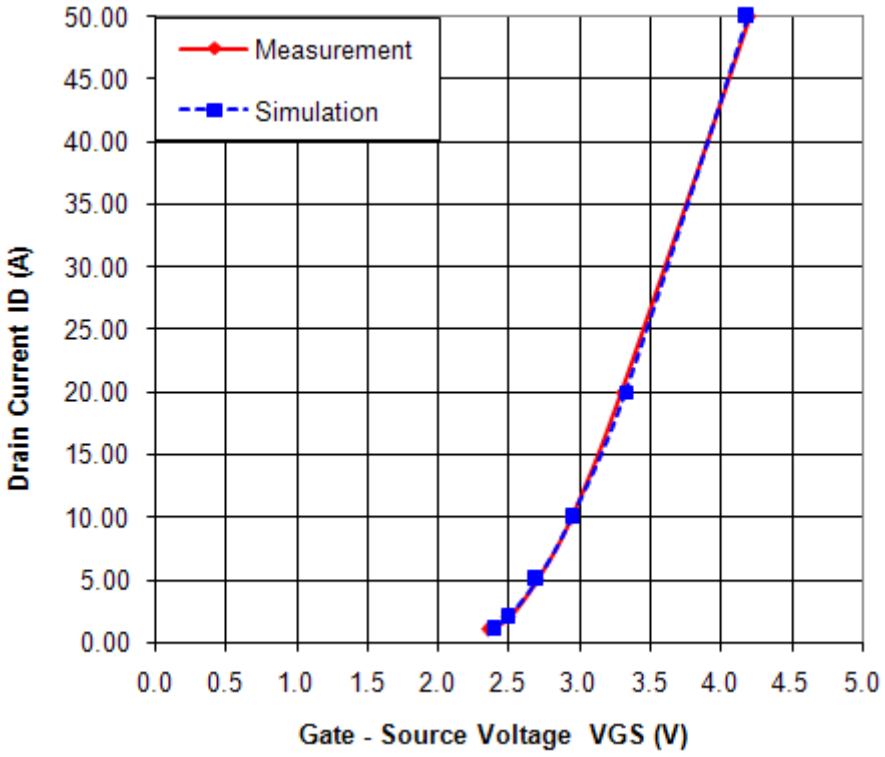


Evaluation circuit



Comparison Graph

Circuit Simulation Result

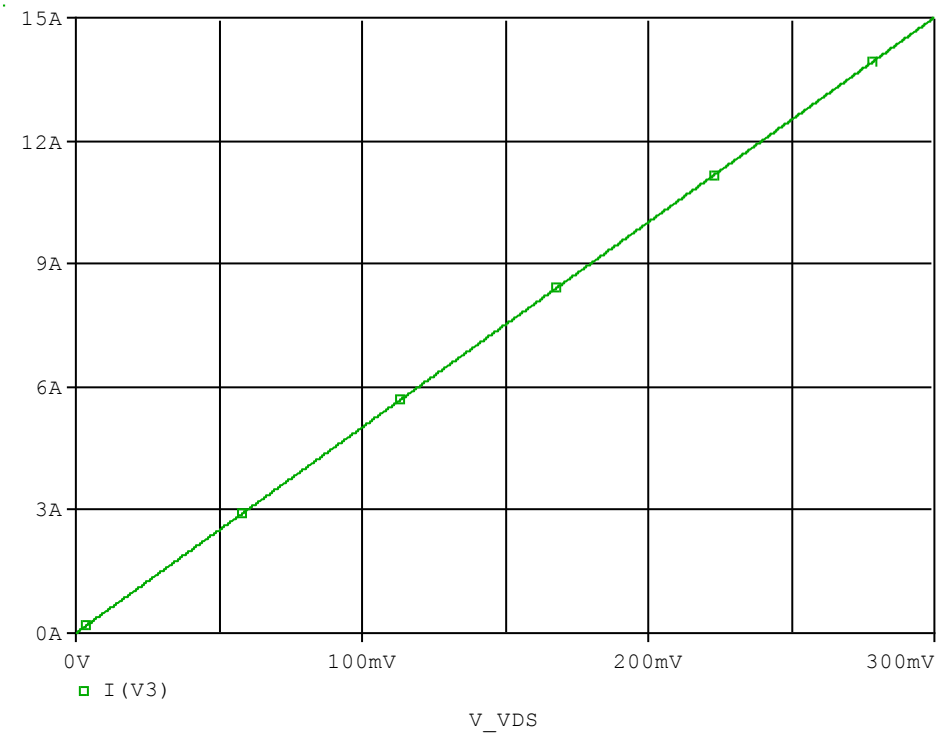


Simulation Result

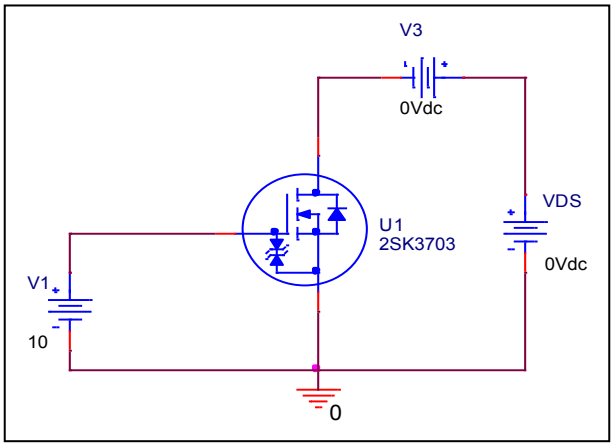
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
1	2.350	2.392	1.80
2	2.500	2.491	-0.36
5	2.700	2.698	-0.09
10	2.950	2.946	-0.12
20	3.300	3.328	0.84
50	4.200	4.186	-0.34

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

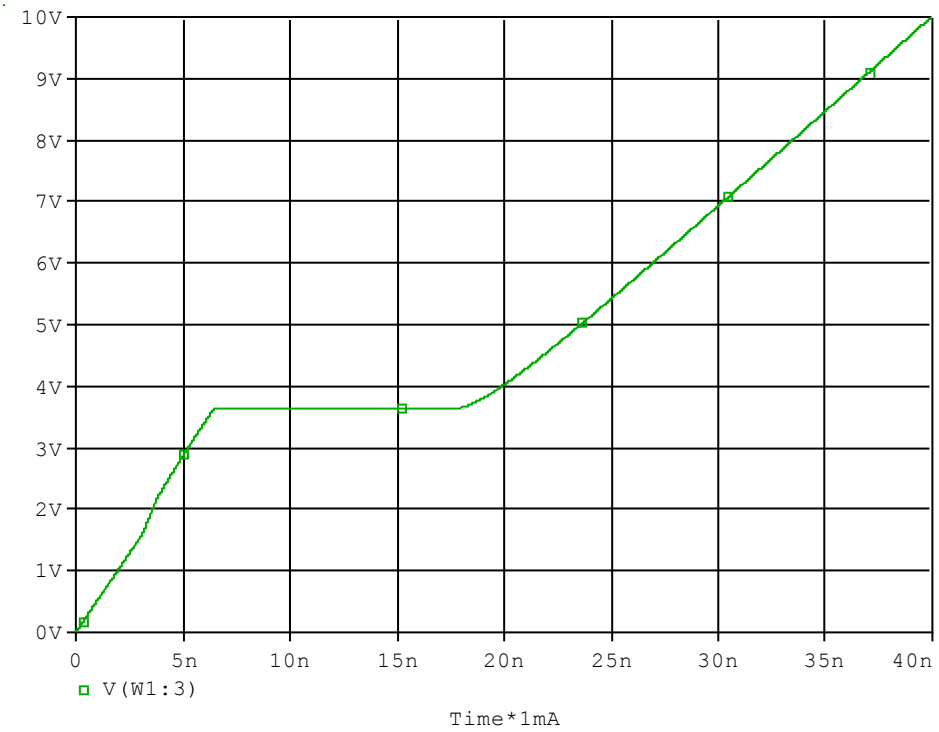


Simulation Result

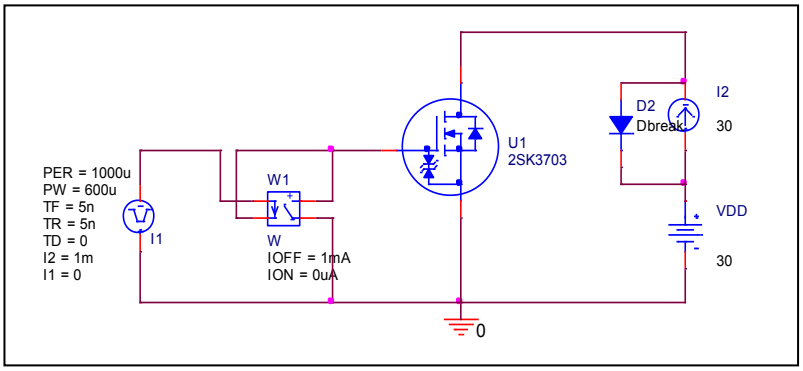
I_D = 15A, V_{GS} = 10V		Measurement	Simulation	Error (%)
R_{DS} (on)	mΩ	20.000	20.000	0.00

Gate Charge Characteristic

Circuit Simulation result



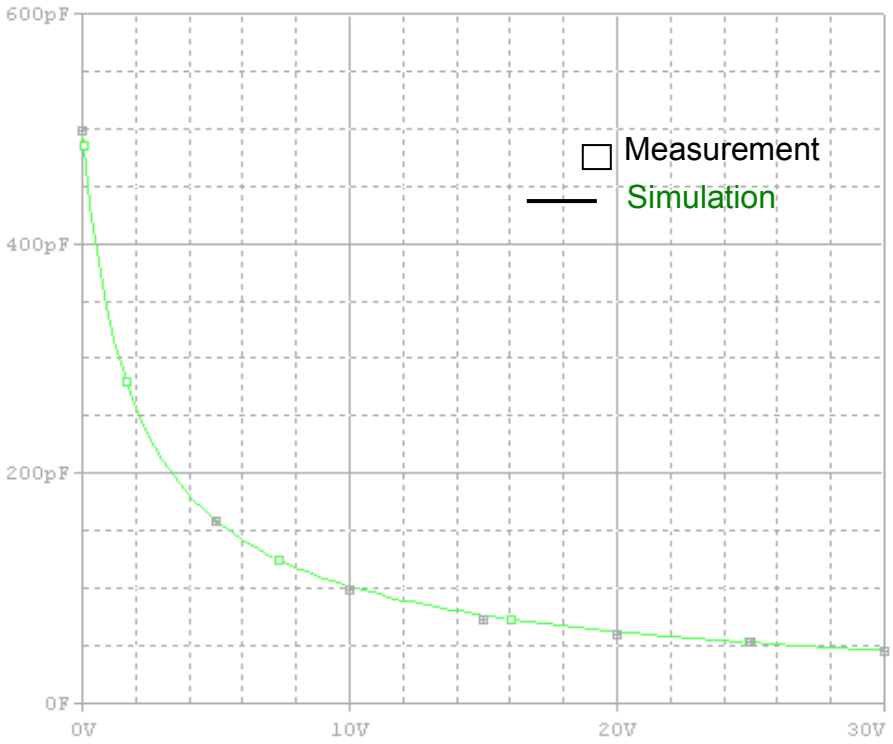
Evaluation circuit



Simulation Result

V_{DD}=30V, I_D=30A, V_{GS}=10V		Measurement	Simulation	Error (%)
Qgs	nC	6.500	6.497	-0.04
Qgd	nC	11.500	11.520	0.17
Qg	nC	40.000	39.950	-0.12

Capacitance Characteristic

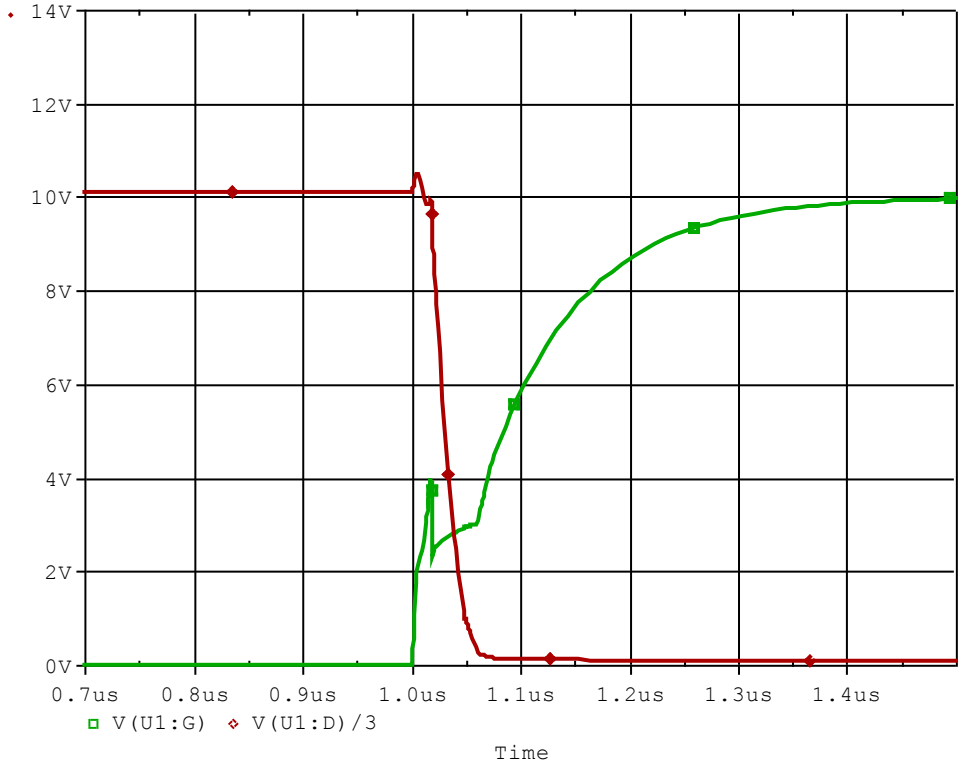


Simulation Result

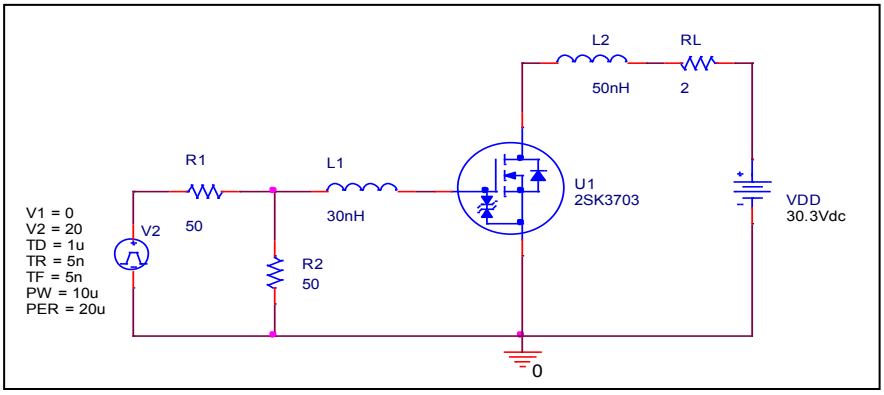
V_{DS} (V)	Cbd (pF)		Error (%)
	Measurement	Simulation	
0.000	500.000	500.000	0.000
5.000	160.000	158.860	-0.71
10.000	100.000	101.660	1.66
15.000	76.000	76.640	0.84
20.000	62.000	62.300	0.48
25.000	53.000	52.897	-0.19
30.000	47.000	46.205	-1.69

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

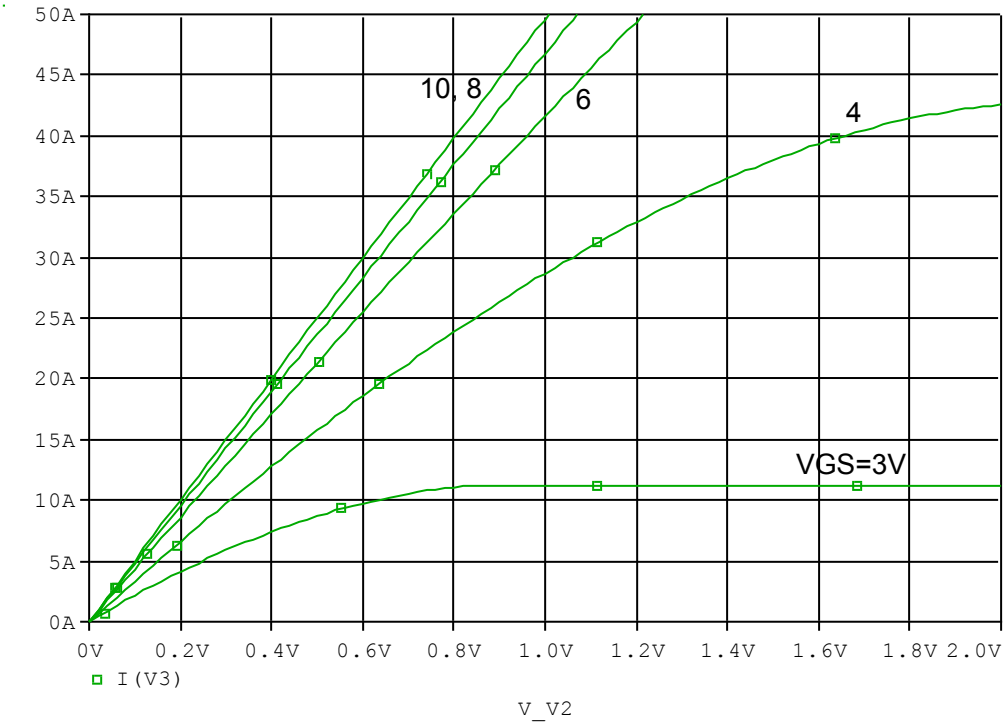


Simulation Result

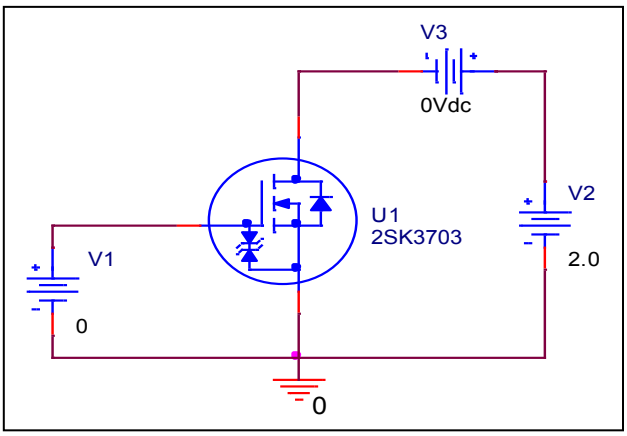
I_D=15A, V_{DD}=30V V_{GS}=0/10V		Measurement	Simulation	Error(%)
td(on)	ns	16.500	16.496	-0.02

Output Characteristic

Circuit Simulation result

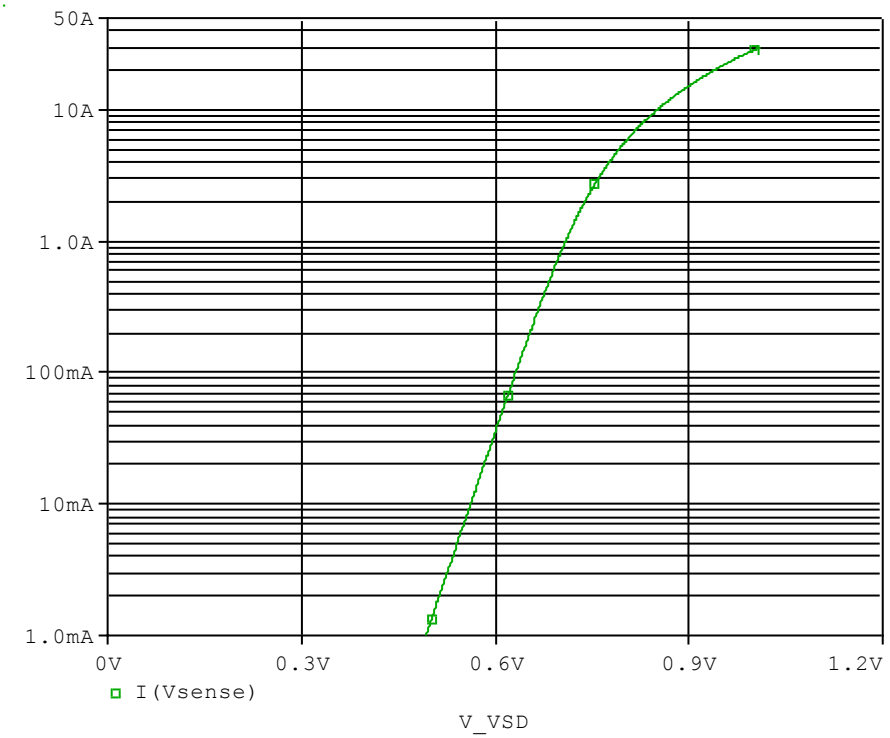


Evaluation circuit

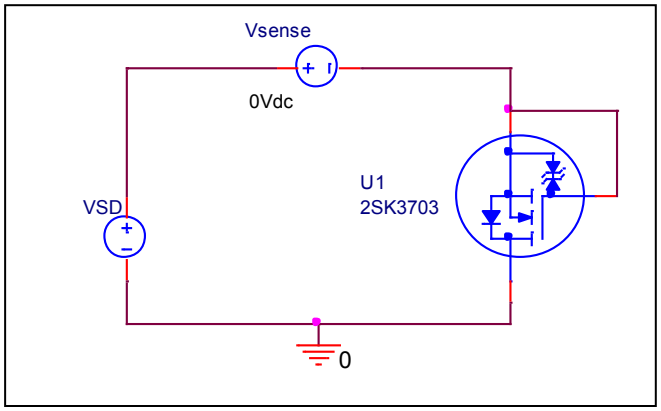


Forward Current Characteristic

Circuit Simulation Result

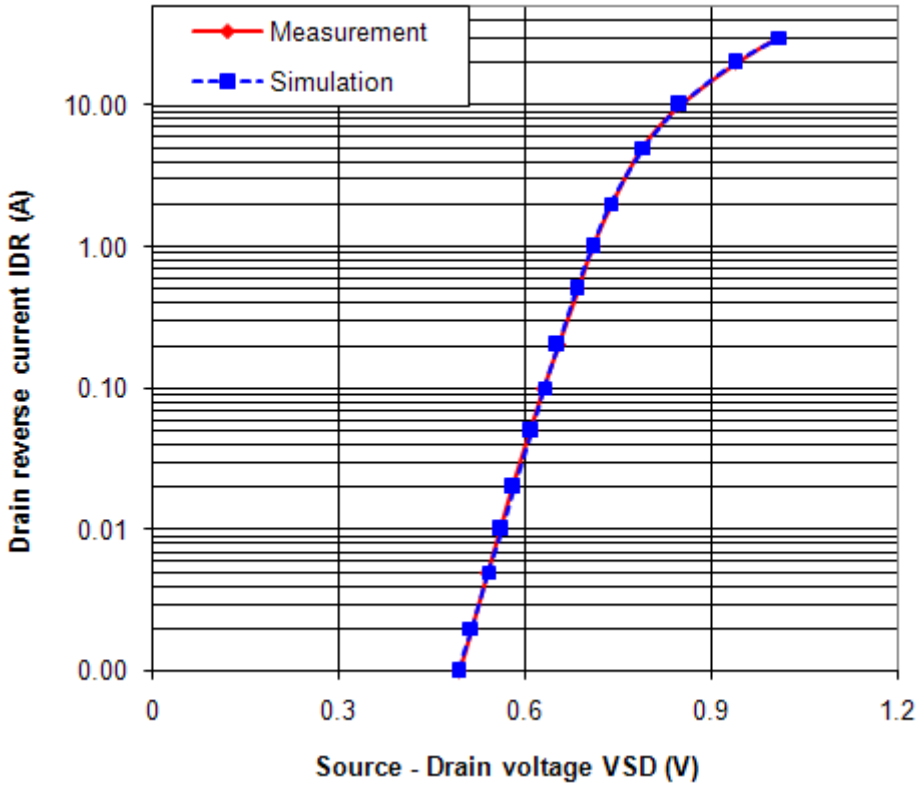


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

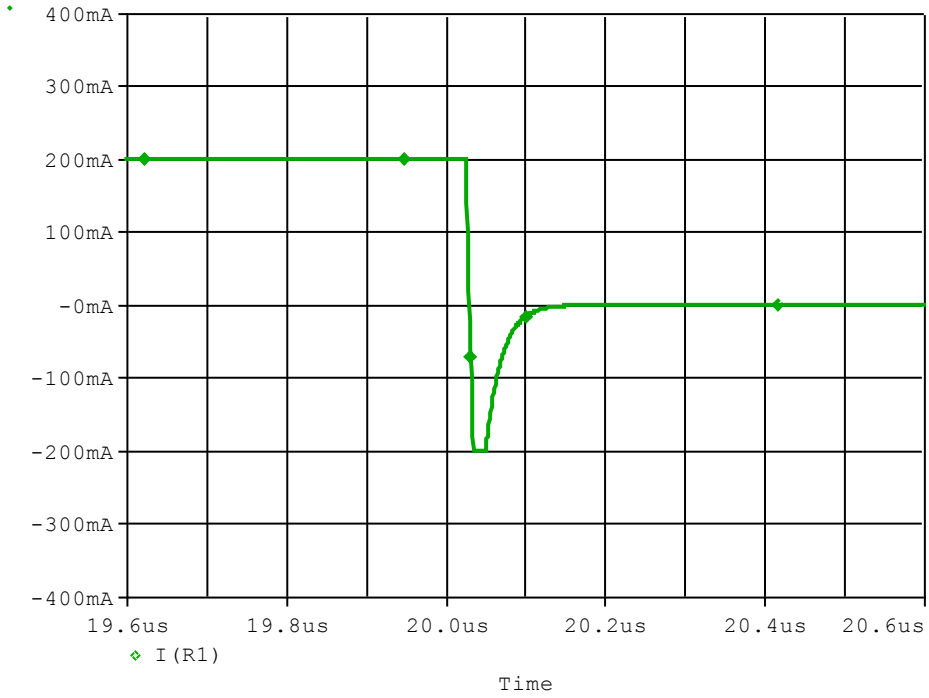


Simulation Result

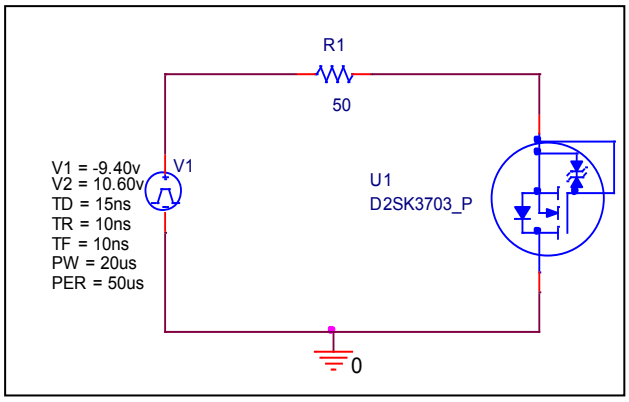
IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
0.001	0.4950	0.4926	-0.48
0.01	0.5600	0.5619	0.34
0.1	0.6300	0.6319	0.30
1	0.7100	0.7090	-0.14
2	0.7400	0.7386	-0.19
5	0.7900	0.7915	0.19
10	0.8500	0.8509	0.10
20	0.9400	0.9386	-0.15
30	1.0100	1.0110	0.10

Reverse Recovery Characteristics

Circuit Simulation Result



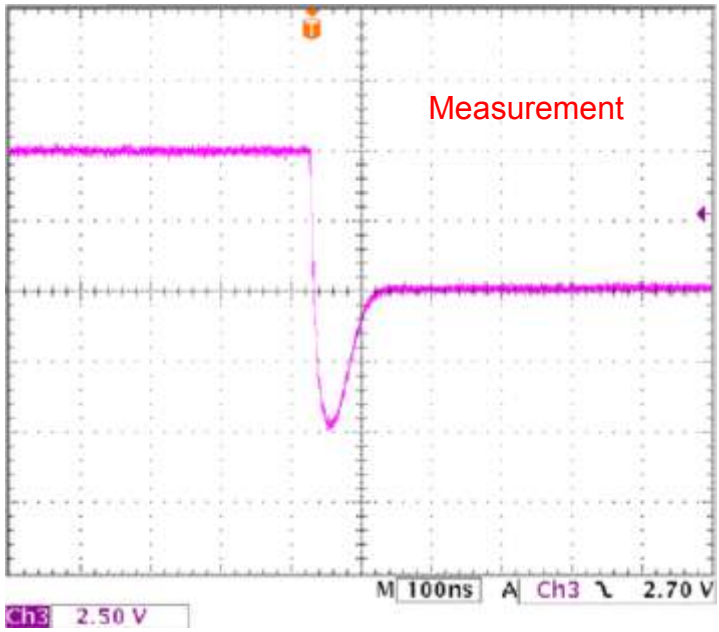
Evaluation Circuit



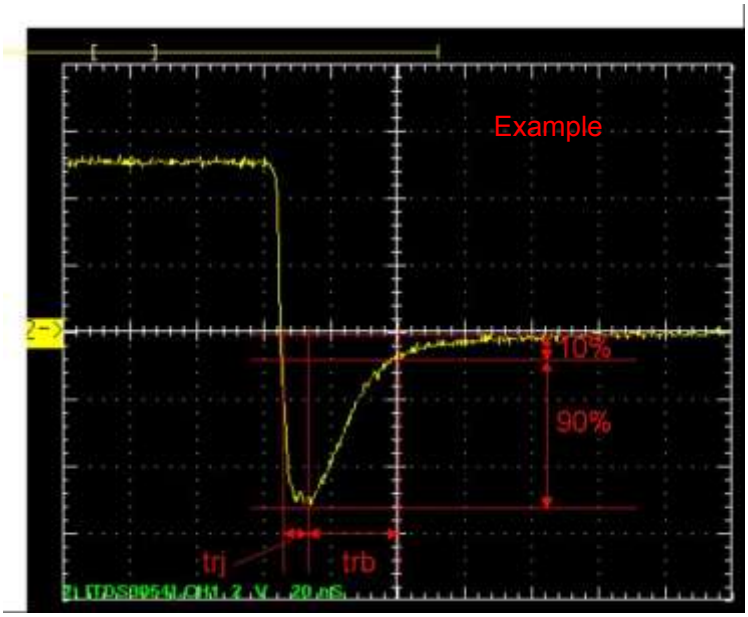
Compare Measurement vs. Simulation

Characteristics	Unit	Measurement	Simulation	Error (%)
trj	ns	20.000	19.700	-1.50
trb	ns	46.000	46.020	0.04
trr	ns	66.000	65.720	-0.42

Reverse Recovery Characteristic Reference



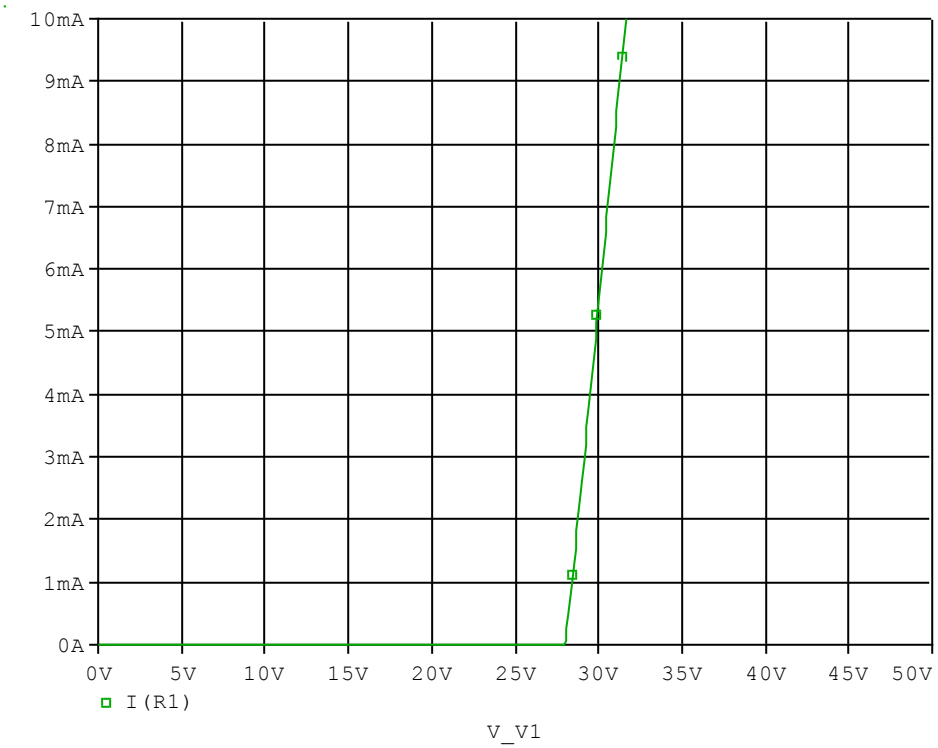
Trj=20(ns)
Trb=46(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



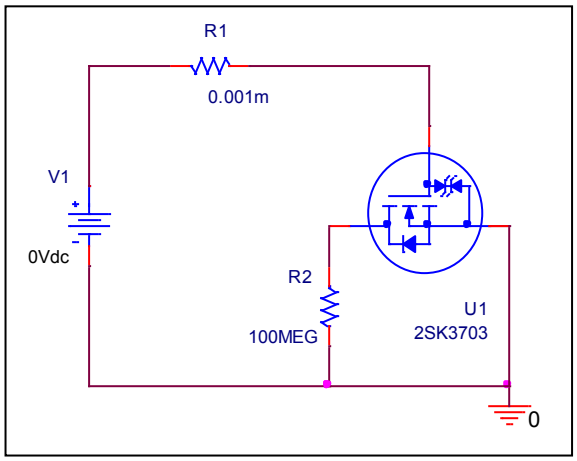
Relation between trj and trb

ESD PROTECTION DIODE SPICE MODEL
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference