

Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameter)
PART NUMBER: 2SK1544
MANUFACTURER: TOSHIBA
Body Diode (Standard)



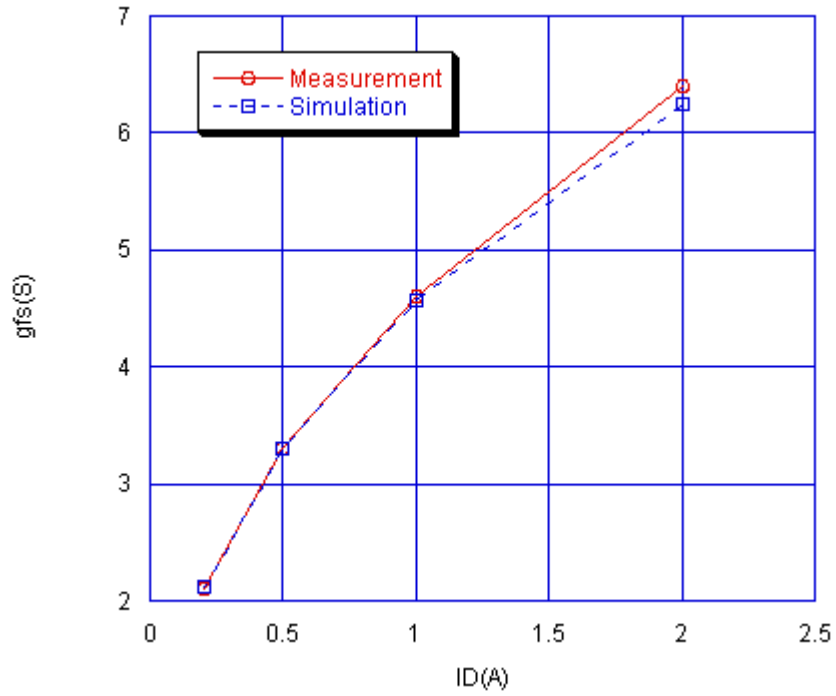
Bee Technologies Inc.

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

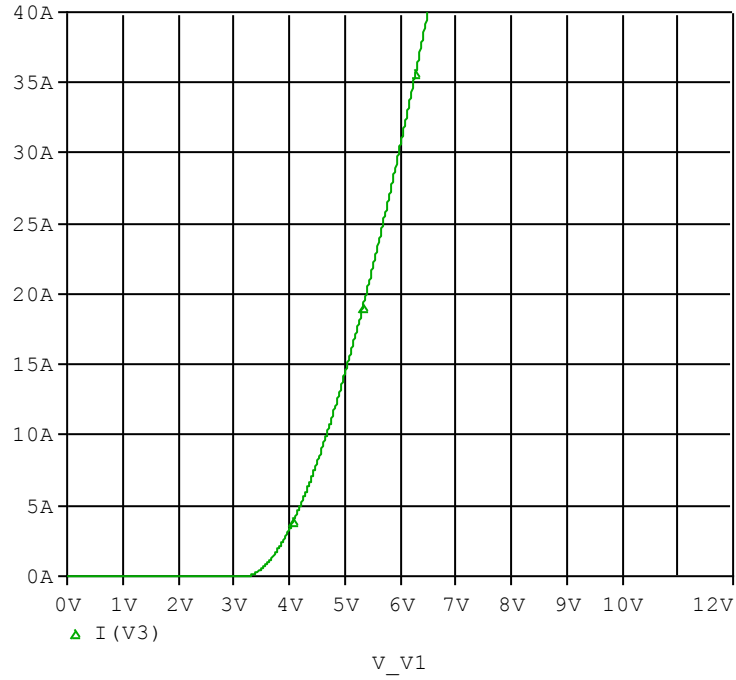


Comparison table

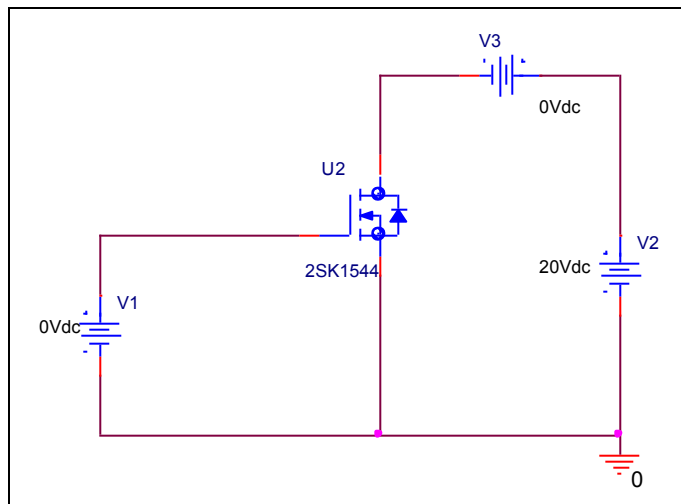
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.200	2.100	2.129	1.381
0.500	3.300	3.301	0.030
1.000	4.600	4.561	-0.848
2.000	6.400	6.249	-2.359

Vgs-Id Characteristic

Circuit Simulation result

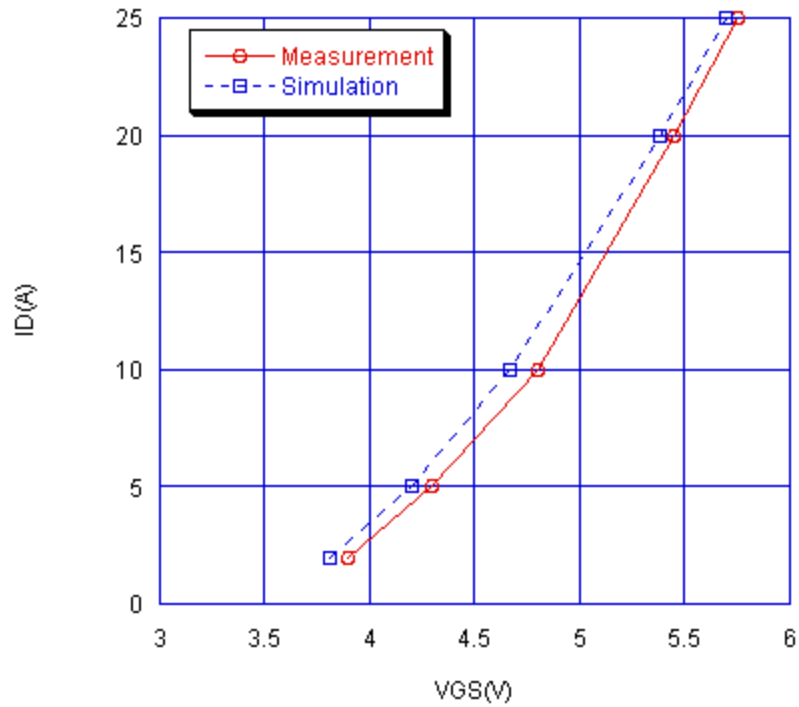


Evaluation circuit



Comparison Graph

Circuit Simulation Result

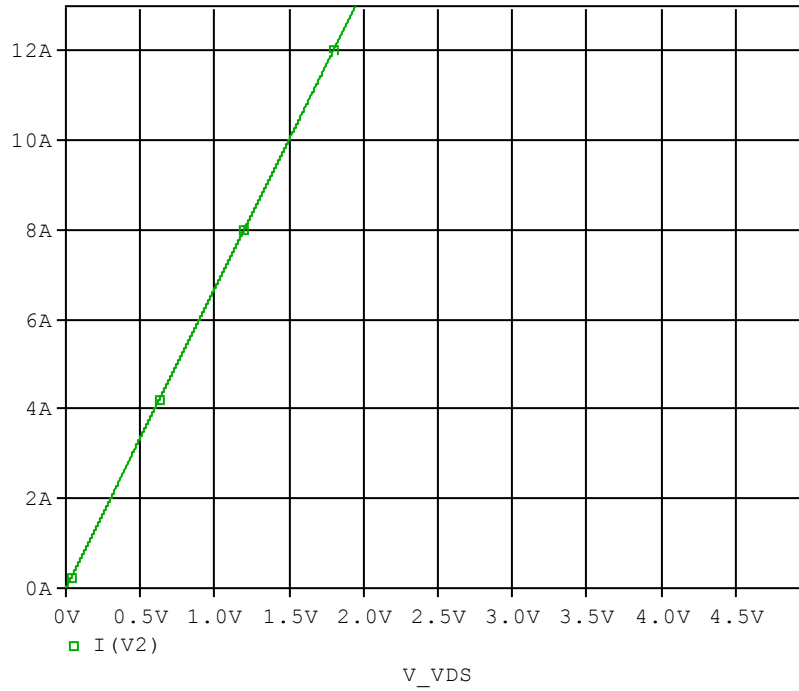


Simulation Result

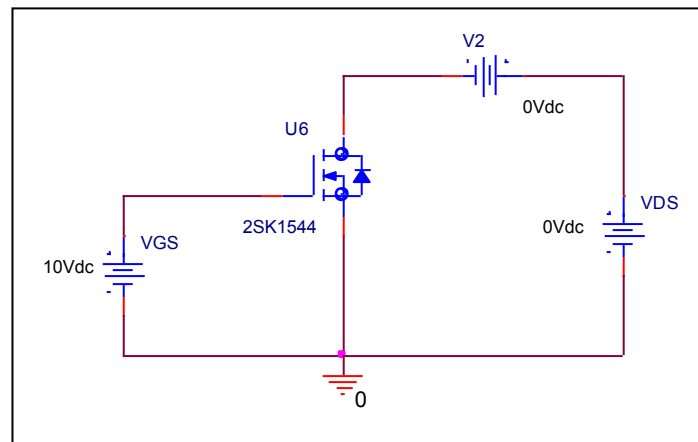
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
2.000	3.900	3.809	-2.333
5.000	4.300	4.201	-2.302
10.000	4.800	4.671	-2.687
20.000	5.450	5.386	-1.174
25.000	5.750	5.691	-1.026

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

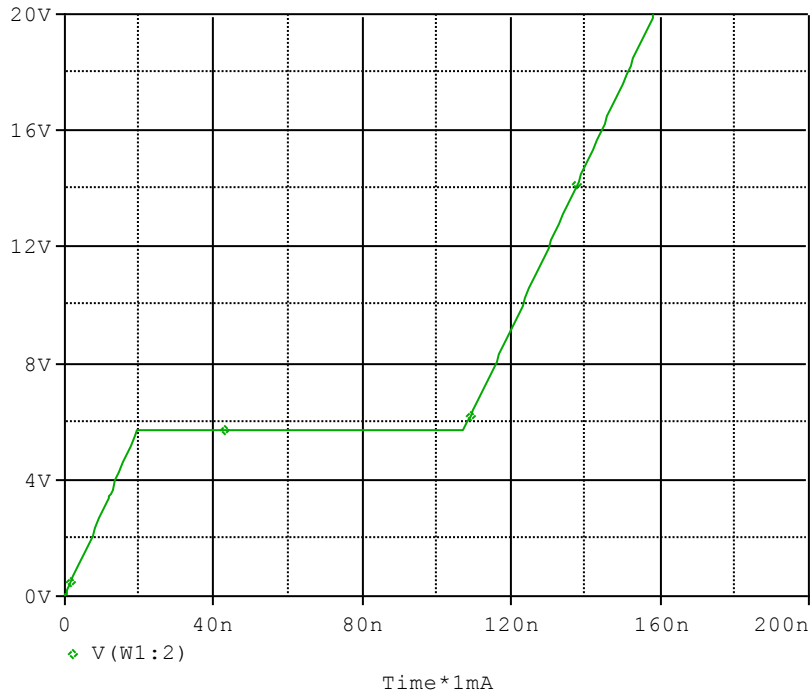


Simulation Result

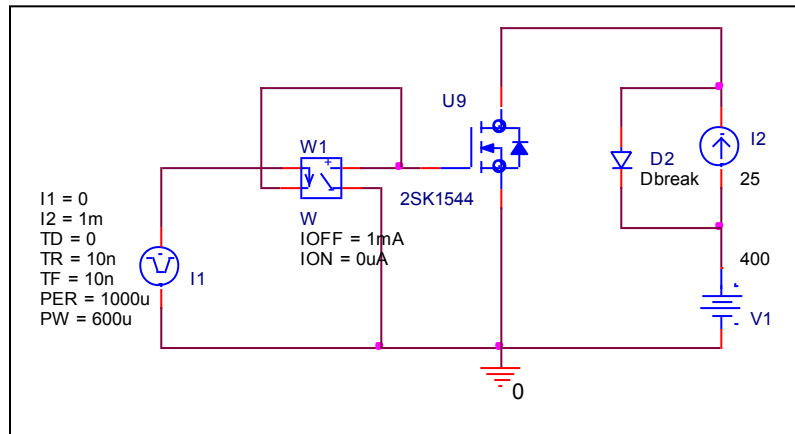
$I_D=13A, V_{GS}=10V$	Measurement		Simulation		Error (%)
$R_{DS(on)}$	0.150	Ω	0.149	Ω	-0.667

Gate Charge Characteristic

Circuit Simulation result



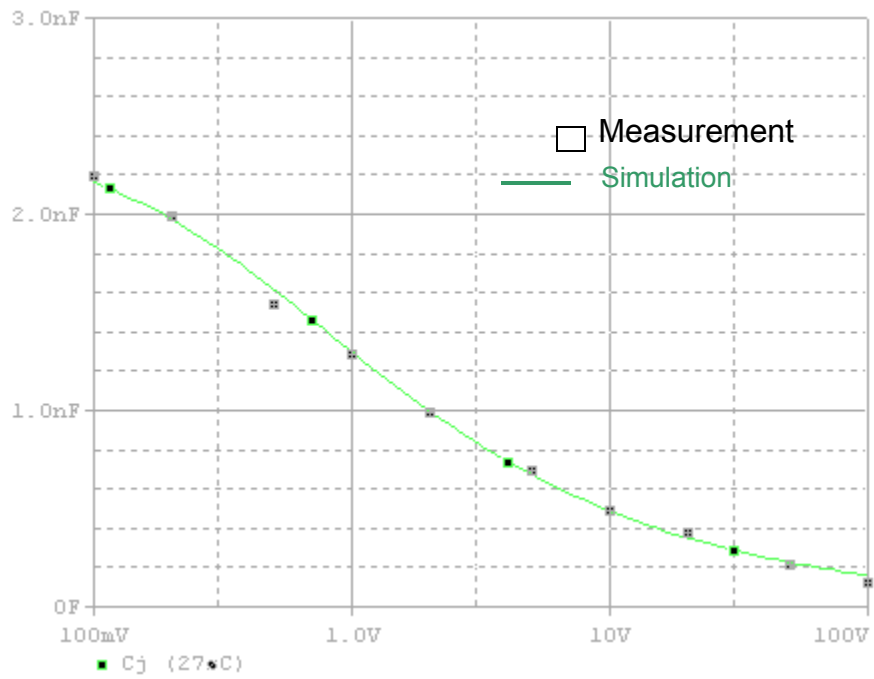
Evaluation circuit



Simulation Result

$V_{DD}=400V, I_D=25A$ $, V_{GS}=10V$	Measurement		Simulation		Error (%)
Qgs	20.000	nC	19.775	nC	-1.125
Qgd	88.000	nC	86.742	nC	-1.430
Qg	150.00	nC	122.926	nC	-18.049

Capacitance Characteristic

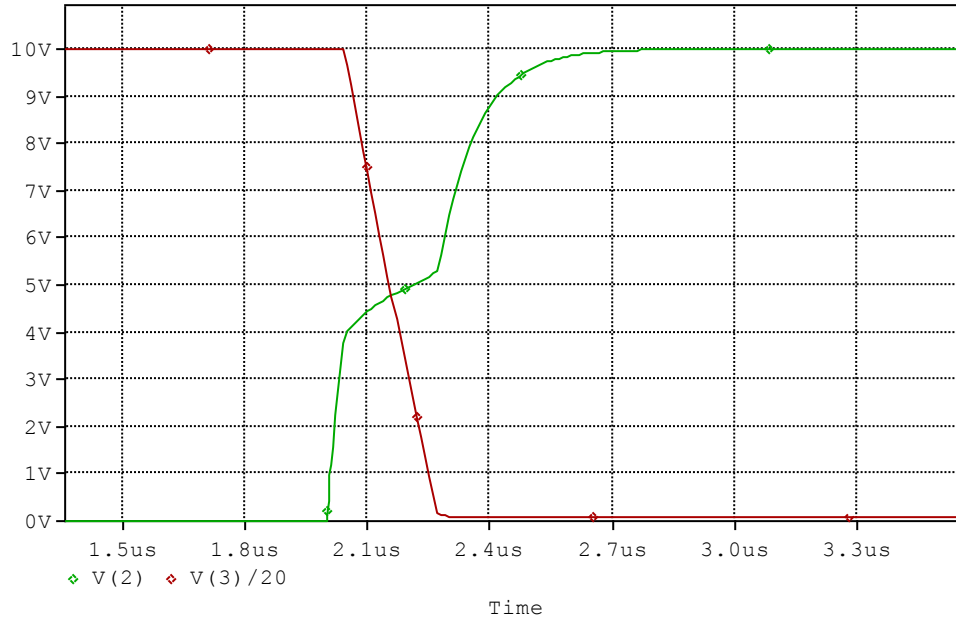


Simulation Result

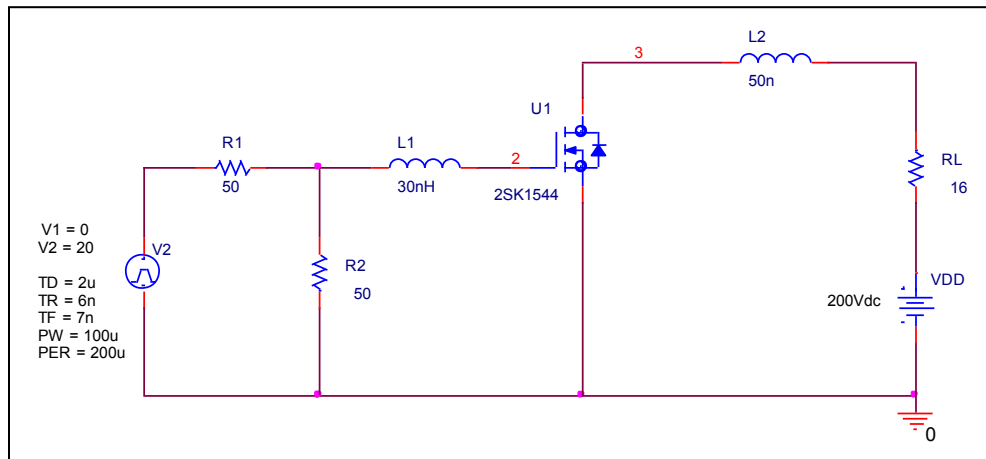
V _{DS} (V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	2200.000	2100.000	4.545
0.200	2000.000	1900.000	5.000
0.500	1550.000	1600.000	-3.226
1.000	1300.000	1300.000	0.000
2.000	1000.000	1000.000	0.000
5.000	700.000	680.000	2.857
10.000	500.000	500.000	0.000
20.000	390.000	395.000	-1.282
50.000	220.000	225.000	-2.273
100.000	130.000	135.000	-3.846

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

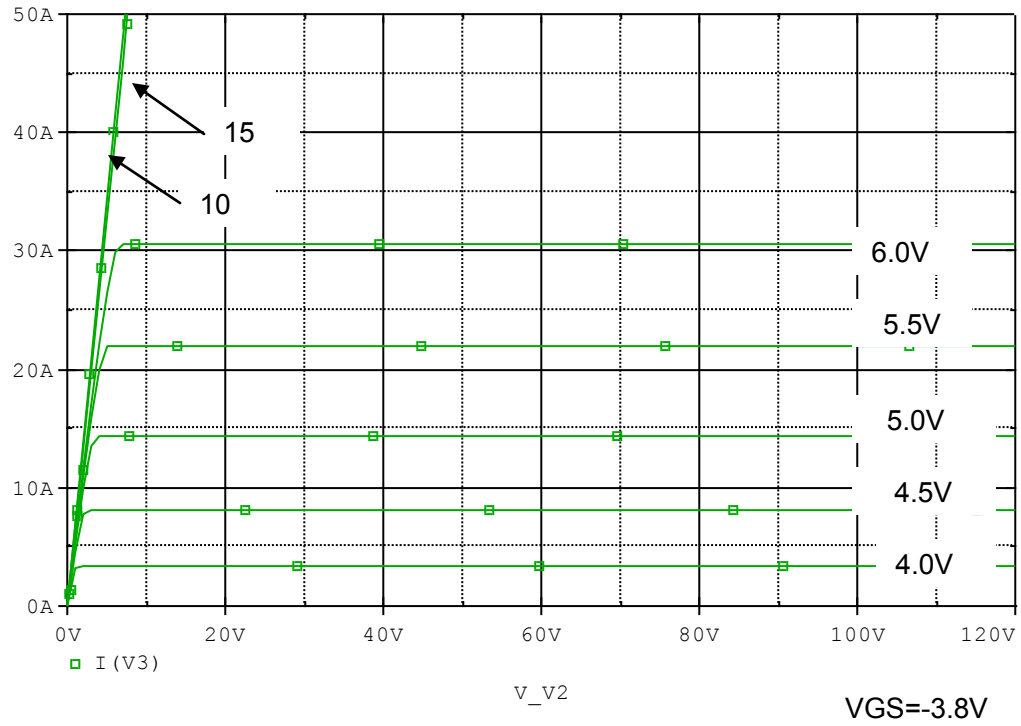


Simulation Result

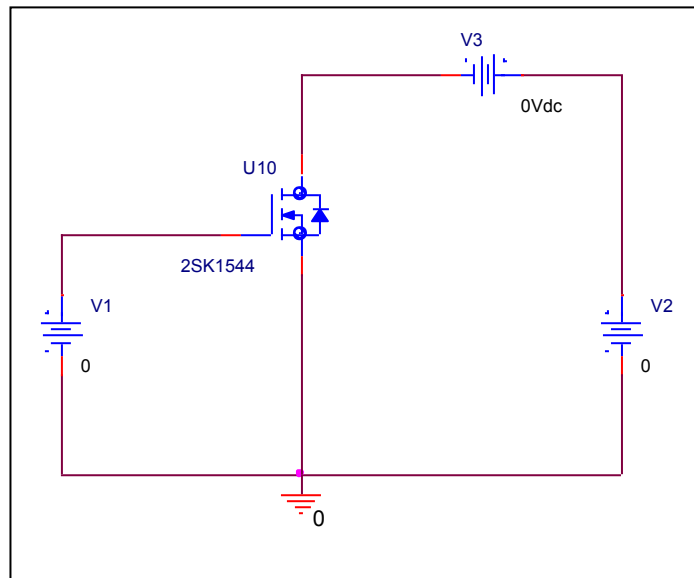
$I_D=25A, V_{DD}=200V$ $V_{GS}=0/10V$	Measurement		Simulation		Error(%)
	ton	240.000 ns	240.750 ns	ns	
					0.313

Output Characteristic

Circuit Simulation result



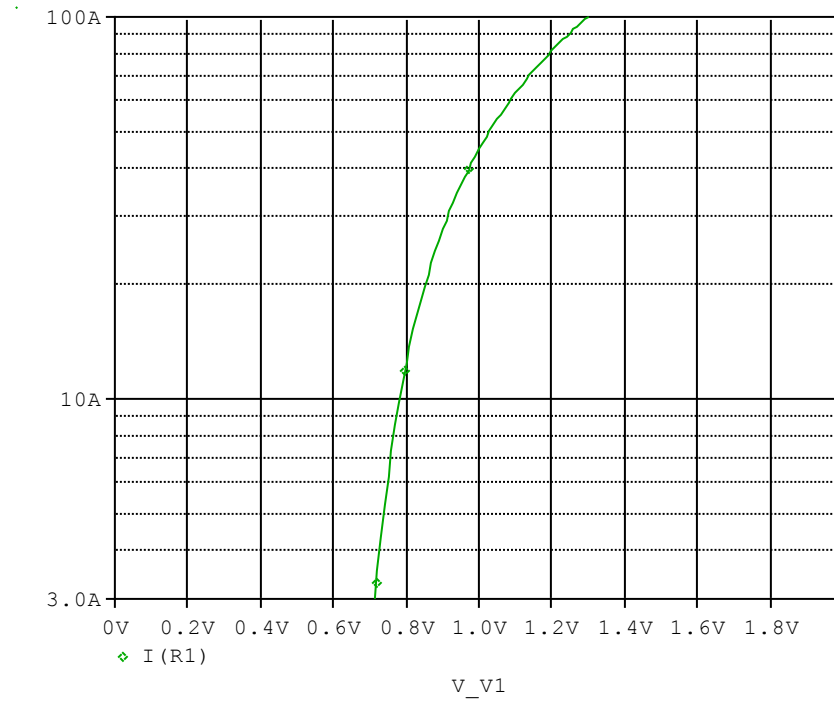
Evaluation circuit



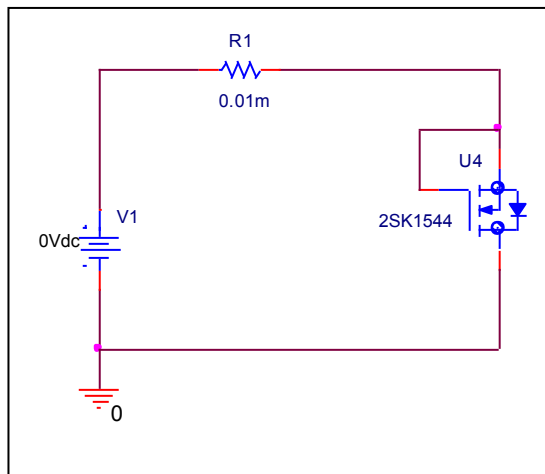
BODY DIODE SPICE MODEL

Forward Current Characteristic

Circuit Simulation Result

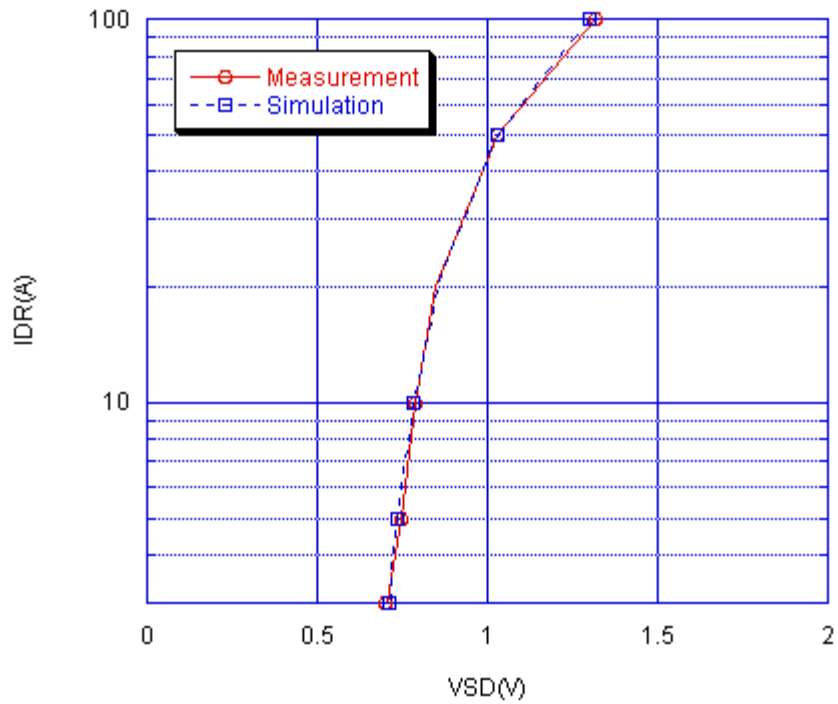


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

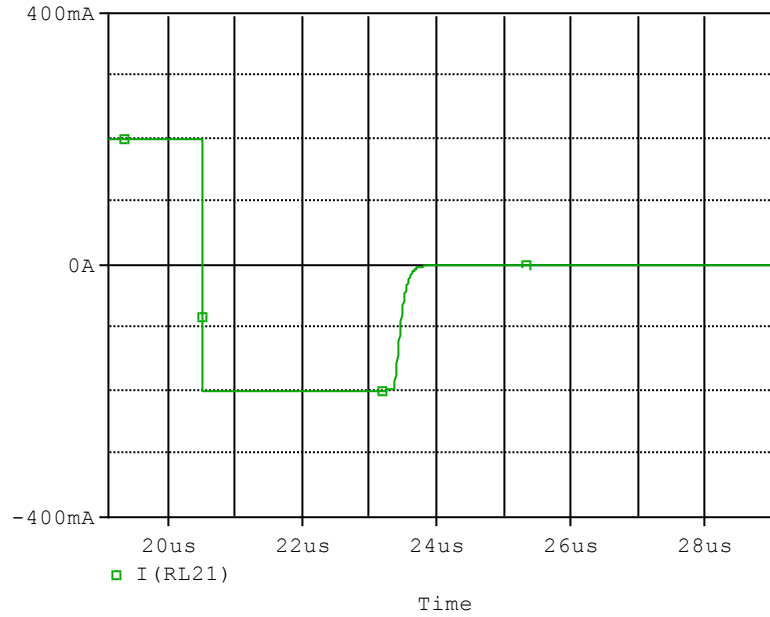


Simulation Result

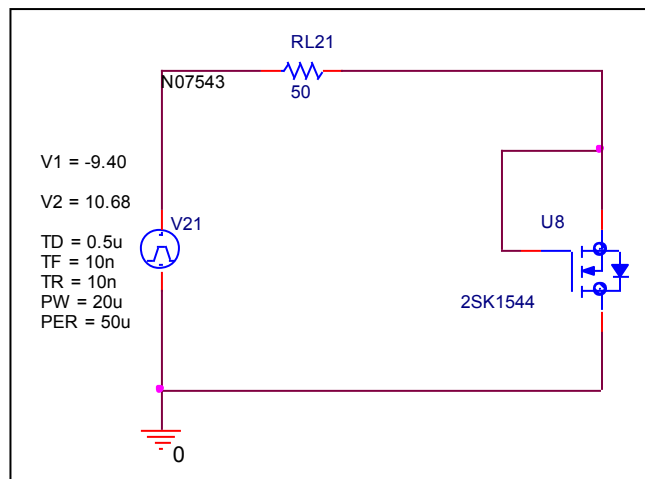
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
3.000	0.700	0.712	1.714
5.000	0.750	0.736	-1.867
10.000	0.790	0.782	-1.013
20.000	0.850	0.851	0.118
50.000	1.030	1.028	-0.194
100.00	1.320	1.298	-1.667

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

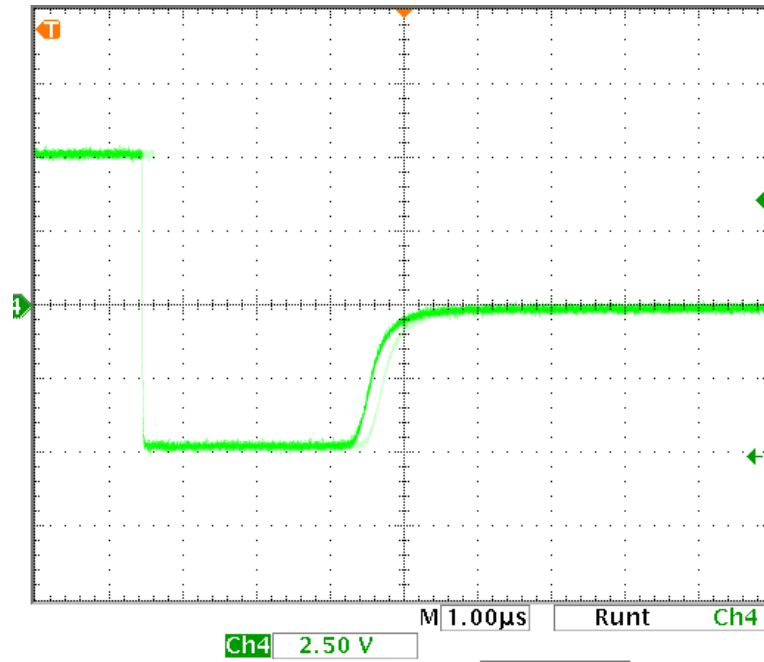


Compare Measurement vs. Simulation

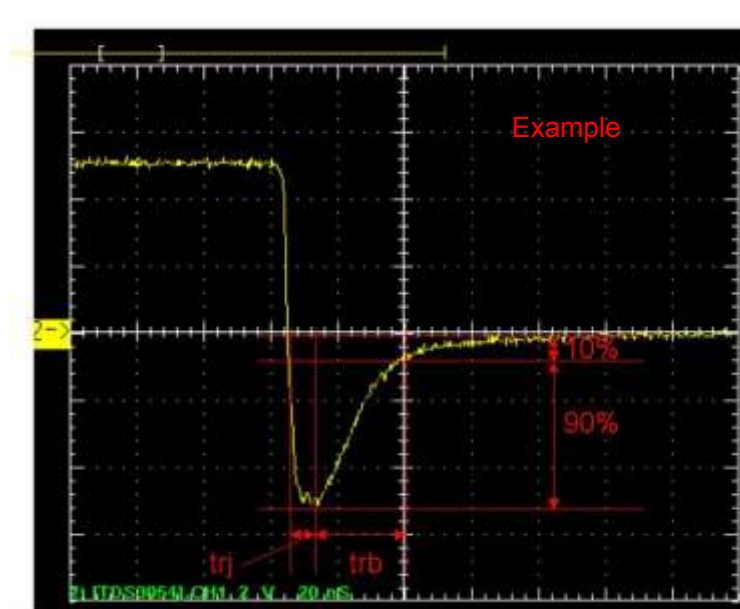
	Measurement		Simulation		Error (%)
trj	2.820	us	2.827	us	0.248
trb	720.000	ns	258.984	ns	-64.030
trr	3.540	us	3.086	us	-12.825

Reverse Recovery Characteristic

Reference



Trj=2.82(us)
Trb=720(ns)
Conditions: Ifwd=Irev=0.2(A), RI=50



Relation between trj and trb