Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SK3454
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

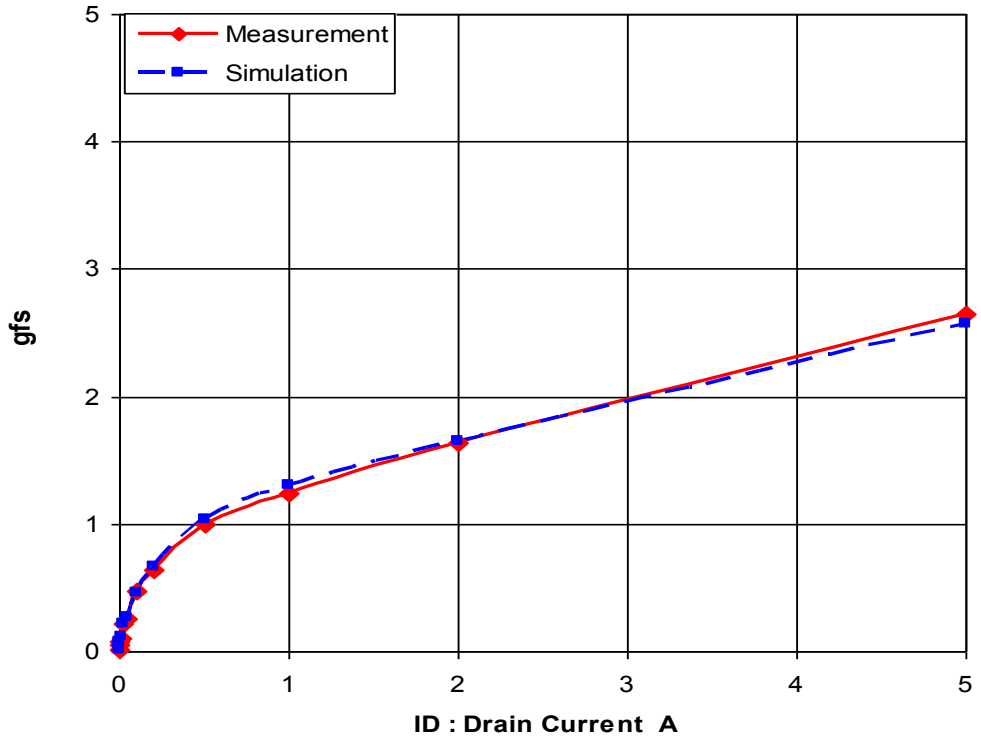
Bee Technologies Inc.

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

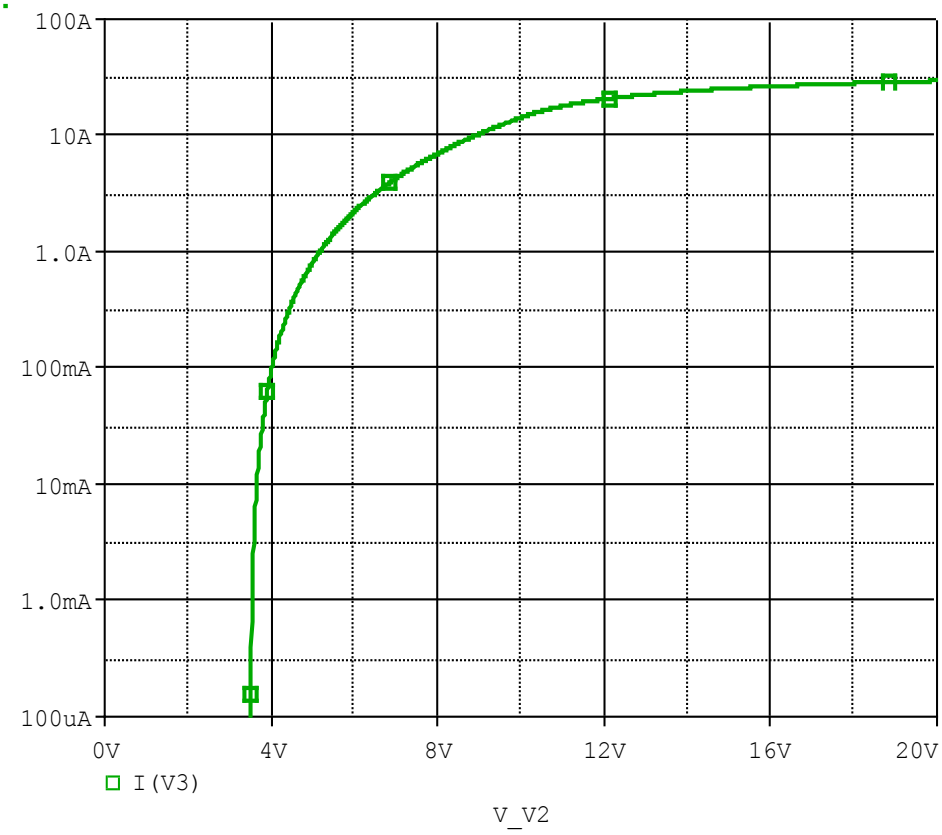


Comparison table

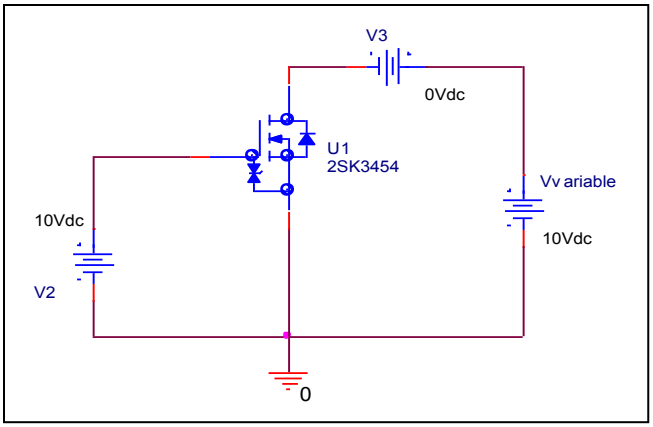
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.001	0.012	0.013	4.839
0.002	0.048	0.050	4.167
0.005	0.080	0.083	3.750
0.01	0.106	0.111	4.717
0.02	0.213	0.222	4.225
0.05	0.257	0.263	2.335
0.1	0.475	0.455	-4.211
0.2	0.634	0.659	3.943
0.5	1.002	1.042	3.992
1	1.246	1.300	4.334

Vgs-Id Characteristic

Circuit Simulation result

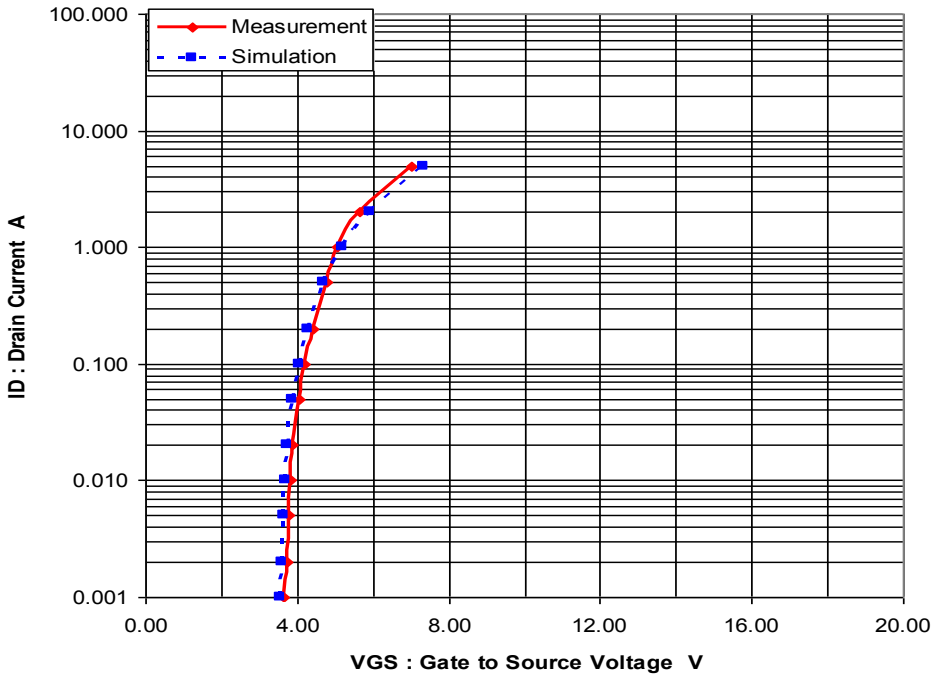


Evaluation circuit



Comparison Graph

Circuit Simulation Result

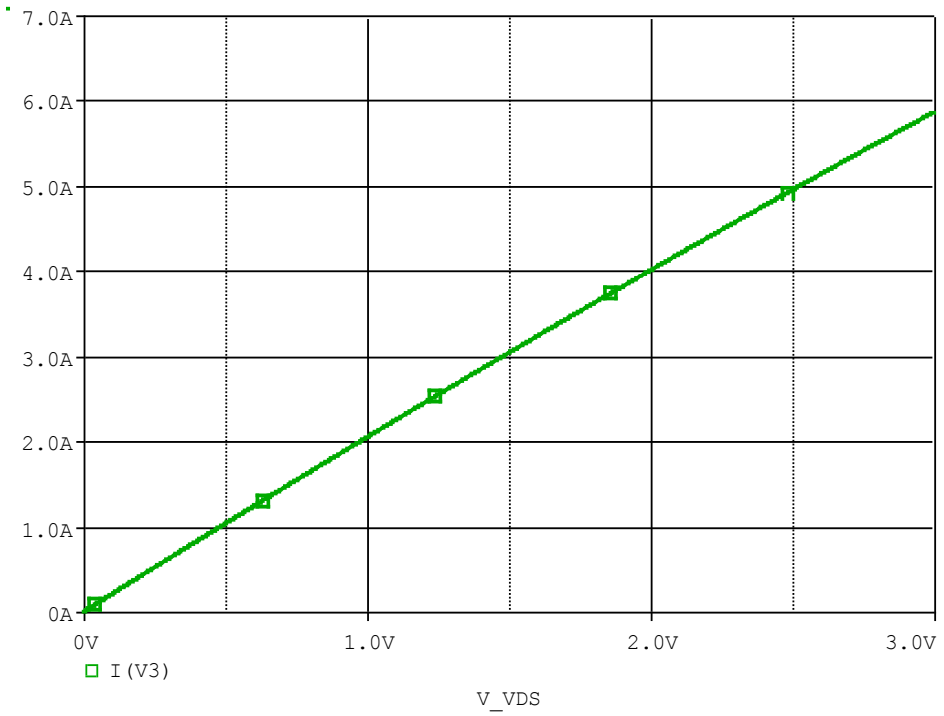


Simulation Result

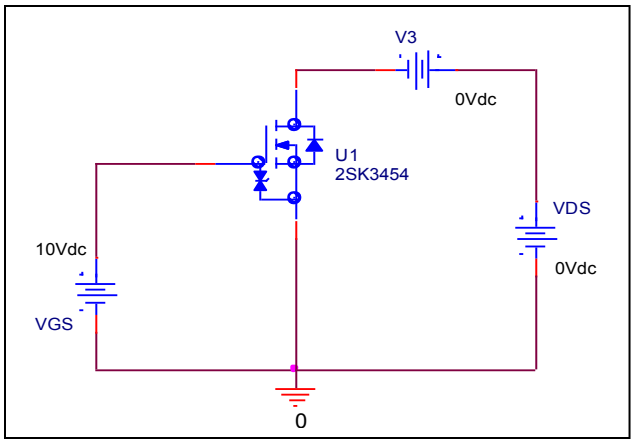
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.001	3.640	3.570	-1.923
0.002	3.730	3.593	-3.673
0.005	3.760	3.636	-3.298
0.010	3.810	3.685	-3.281
0.020	3.865	3.758	-2.768
0.050	4.053	3.894	-3.923
0.100	4.213	4.050	-3.869
0.200	4.420	4.270	-3.394
0.500	4.770	4.708	-1.300
1.000	5.070	5.213	2.821
2.000	5.665	5.929	4.660
5.000	7.012	7.345	4.749

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

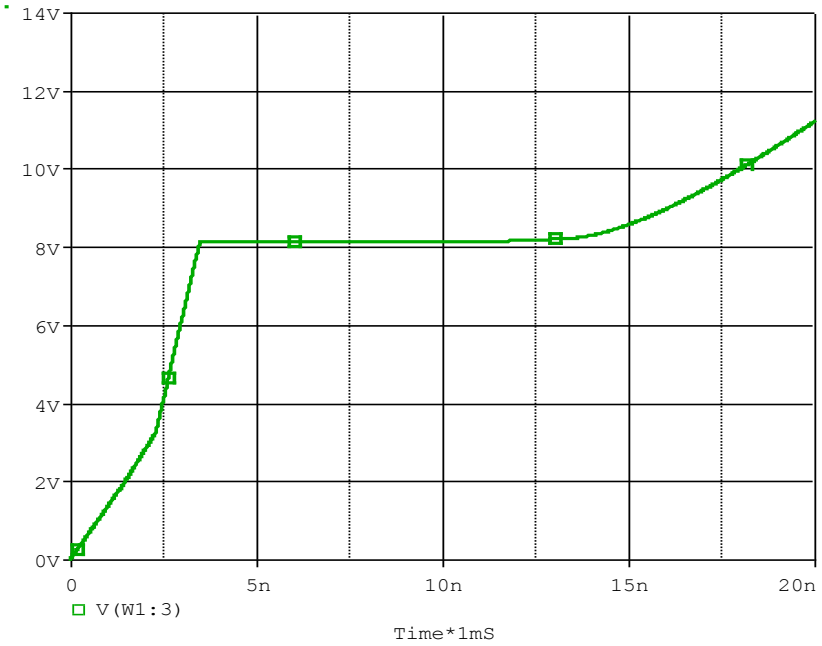


Simulation Result

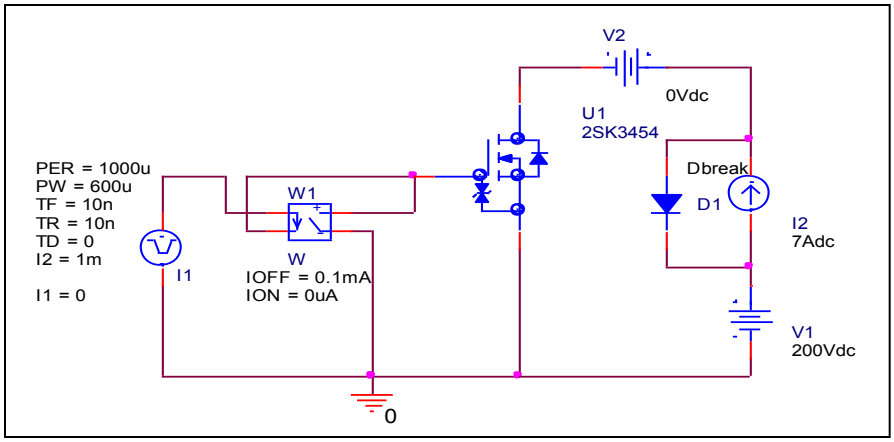
I_D=4A, V_{GS}=10V	Measurement	Simulation	Error (%)
R_{DS} (on) (Ω)	0.500	0.499	-0.200

Gate Charge Characteristic

Circuit Simulation result



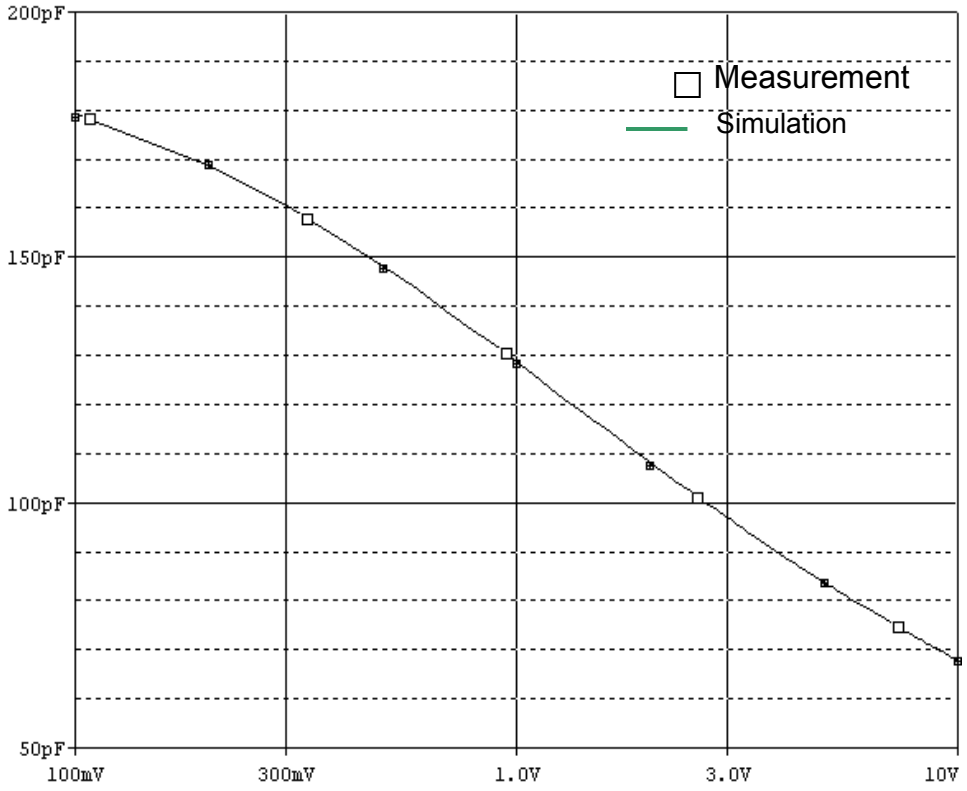
Evaluation circuit



Simulation Result

V_{DD}=200V,I_D=7A ,V_{GS}=10V	Measurement	Simulation	Error (%)
Qgs(nc)	3.500	3.508	0.229
Qgd(nc)	13.500	13.509	0.067
Qg(nc)	11.000	10.995	-0.045

Capacitance Characteristic

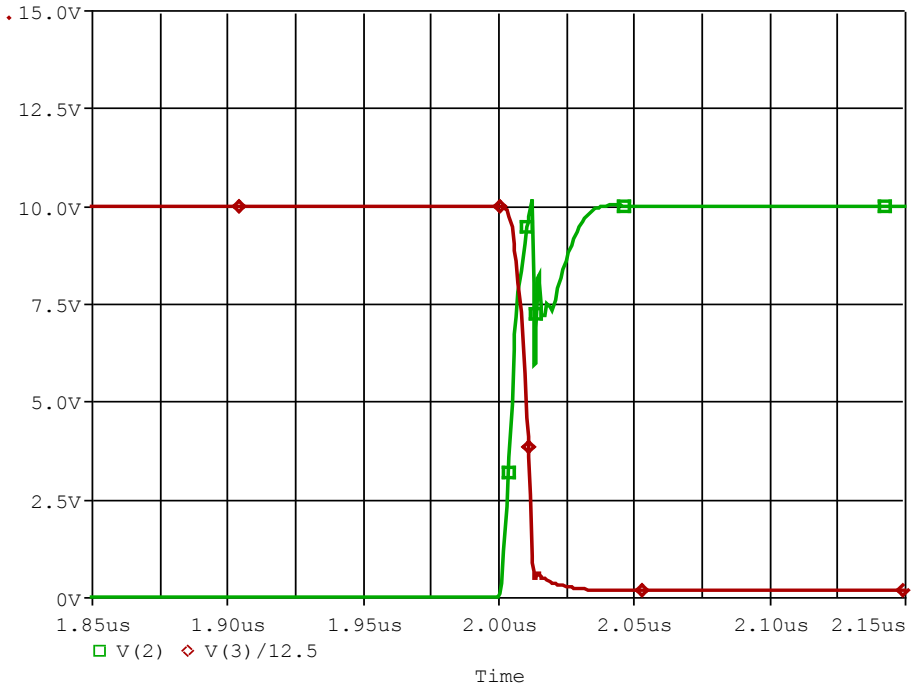


Simulation Result

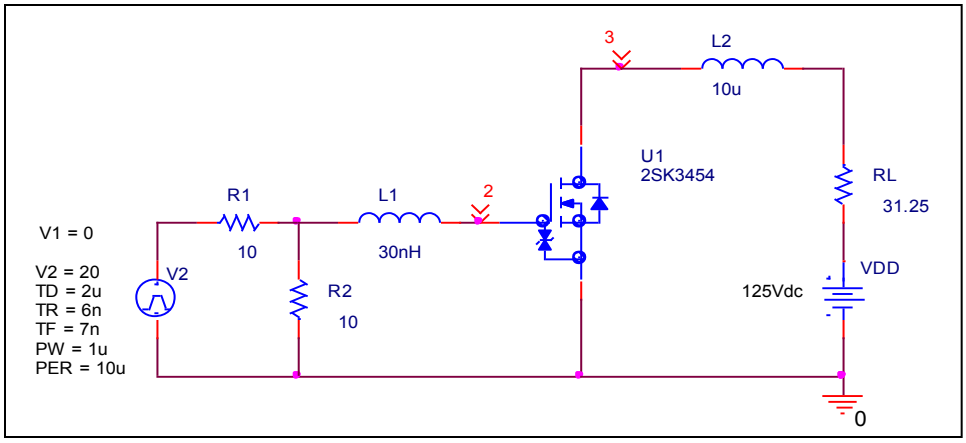
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	179.000	179.070	0.039
0.2	169.200	169.180	-0.012
0.5	147.900	147.850	-0.034
1	128.500	128.498	-0.002
2	108.000	108.021	0.019
5	68.000	67.985	-0.022

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

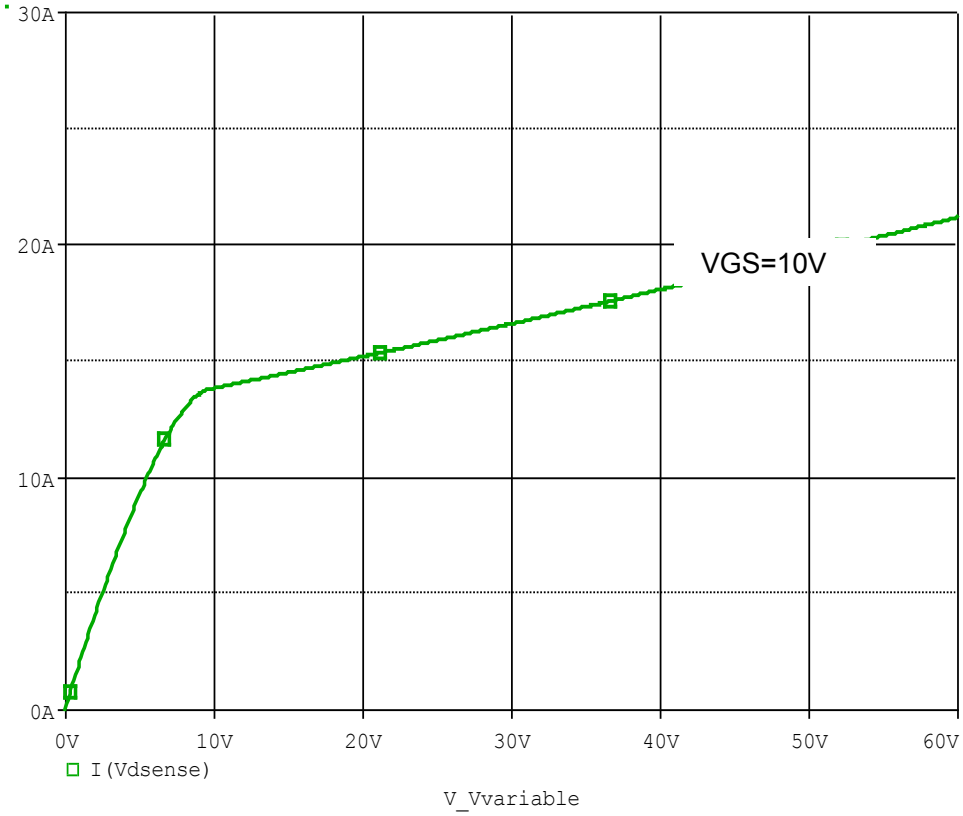


Simulation Result

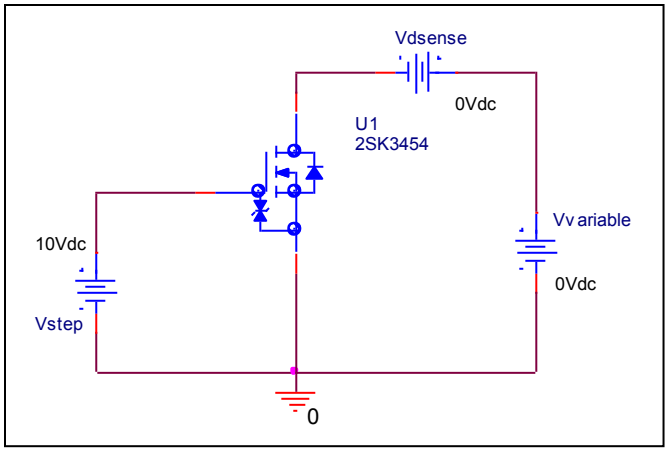
I_D=4A, V_{DD}=125V V_{GS}=10V	Measurement	Simulation	Error(%)
Ton(ns)	11.000	10.995	-0.045

Output Characteristic

Circuit Simulation result

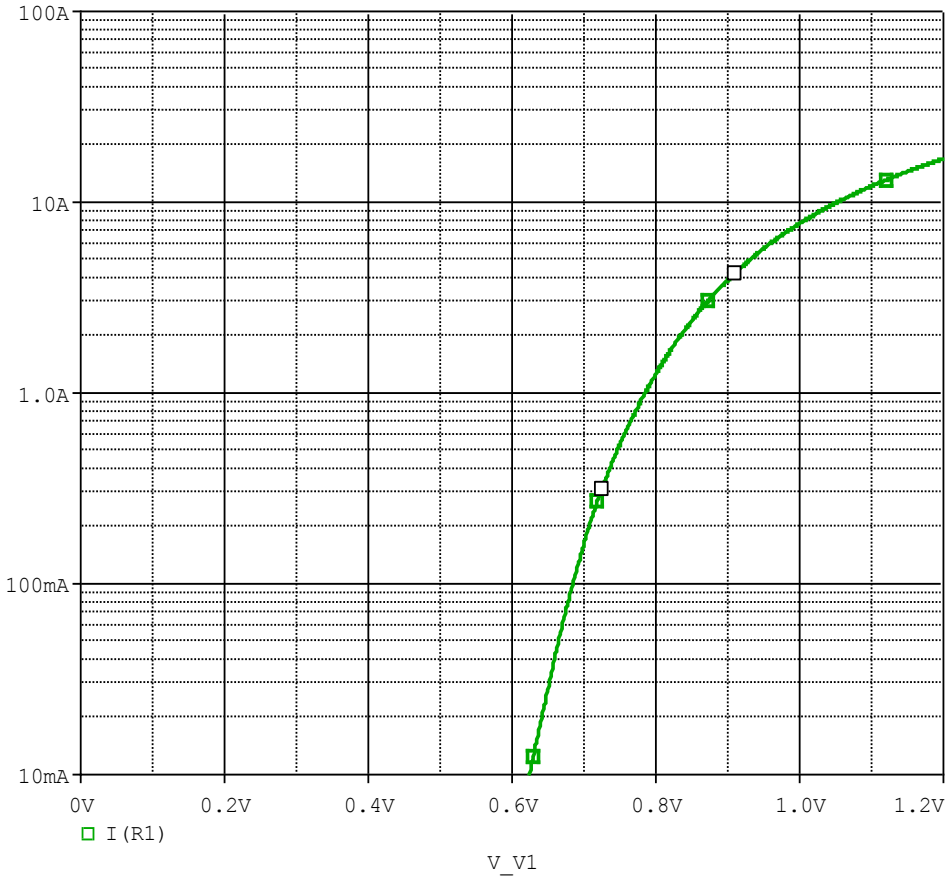


Evaluation circuit

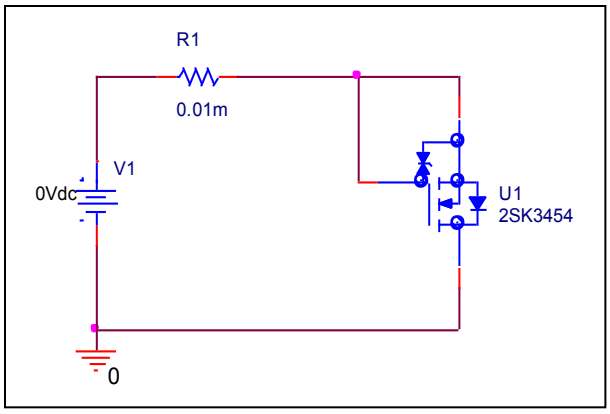


Forward Current Characteristic

Circuit Simulation Result

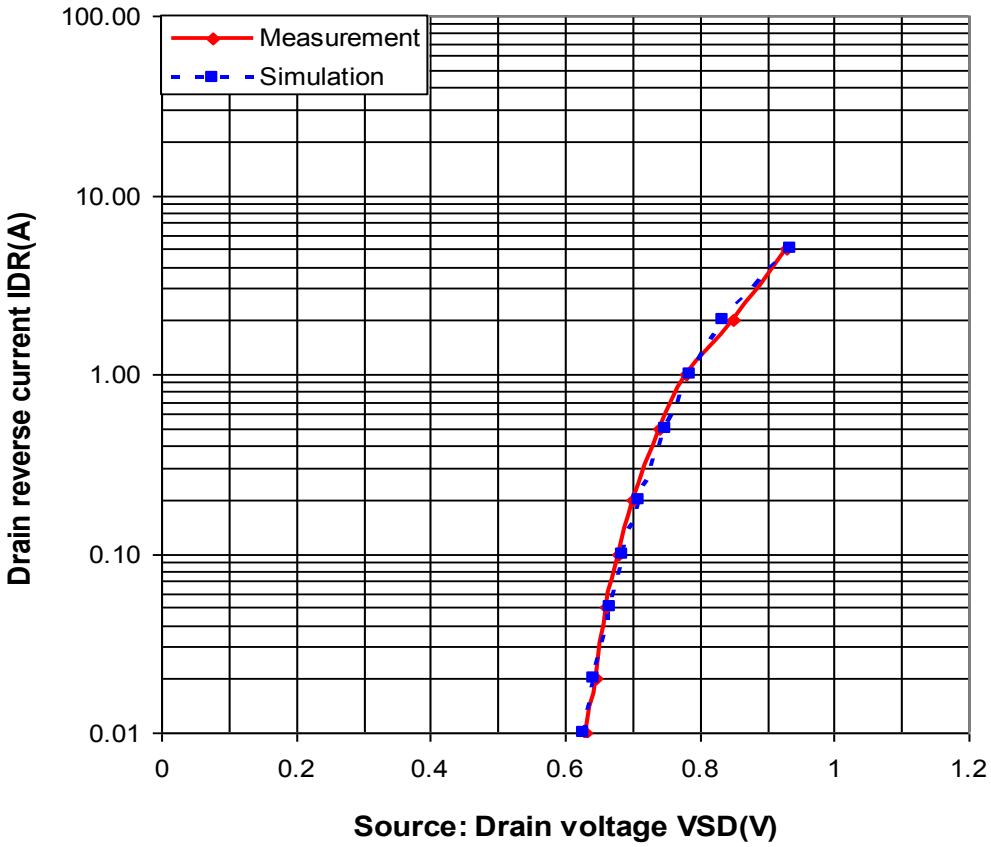


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

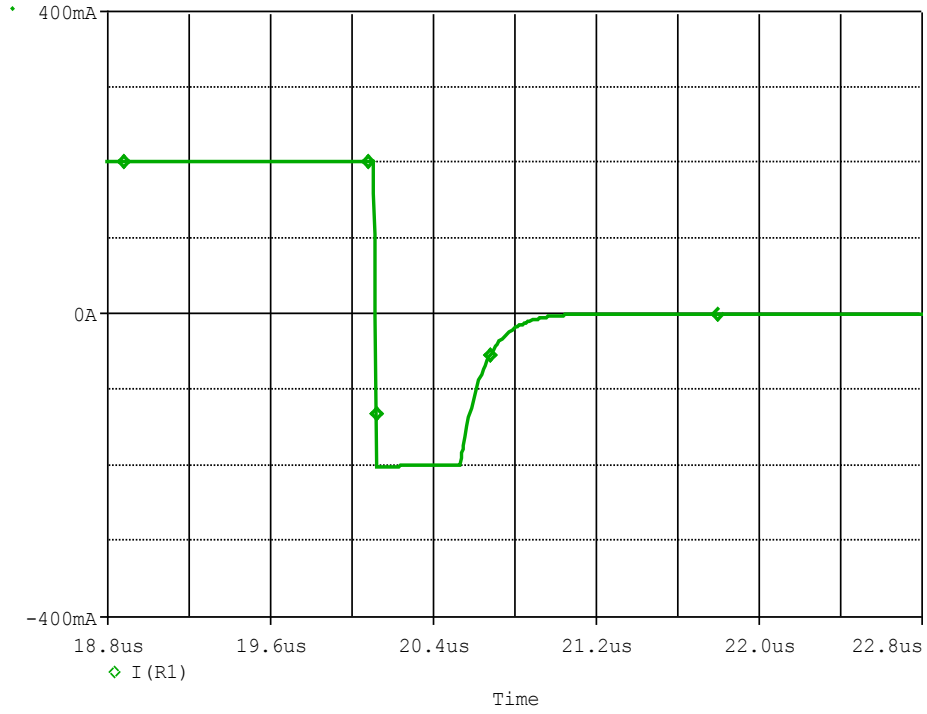


Simulation Result

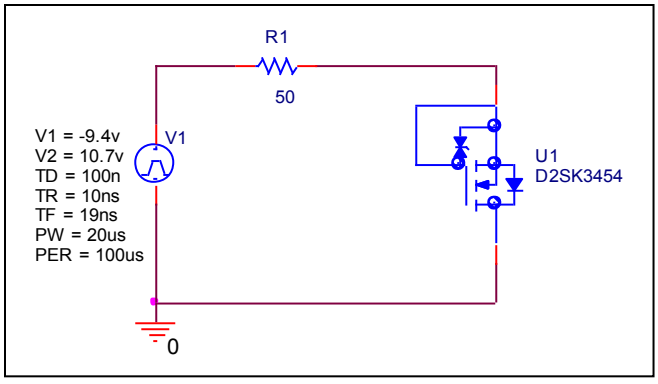
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.010	0.630	0.626	-0.635
0.020	0.645	0.643	-0.310
0.050	0.660	0.666	0.909
0.100	0.680	0.686	0.882
0.200	0.700	0.709	1.286
0.500	0.740	0.748	1.081
1.000	0.780	0.787	0.897
2.000	0.850	0.836	-1.647
5.000	0.930	0.934	0.430

Reverse Recovery Characteristic

Circuit Simulation Result



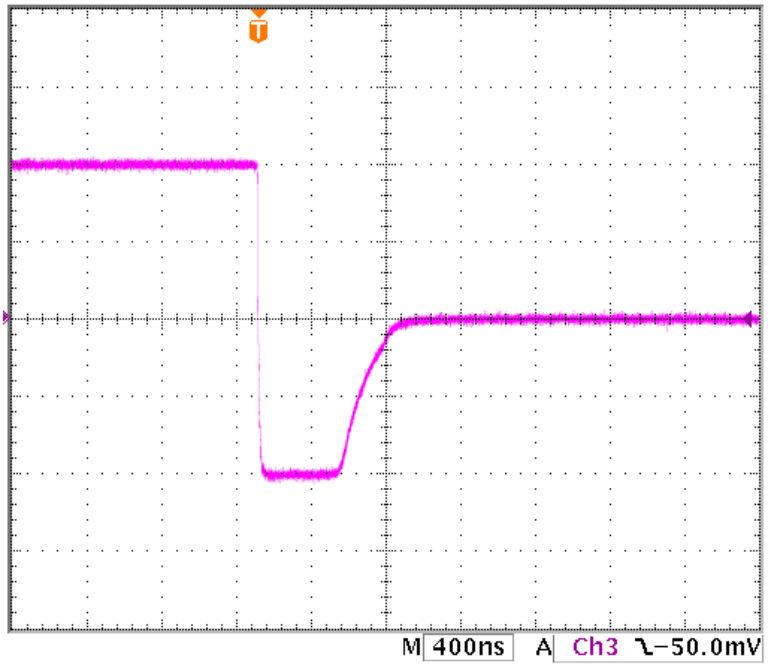
Evaluation Circuit



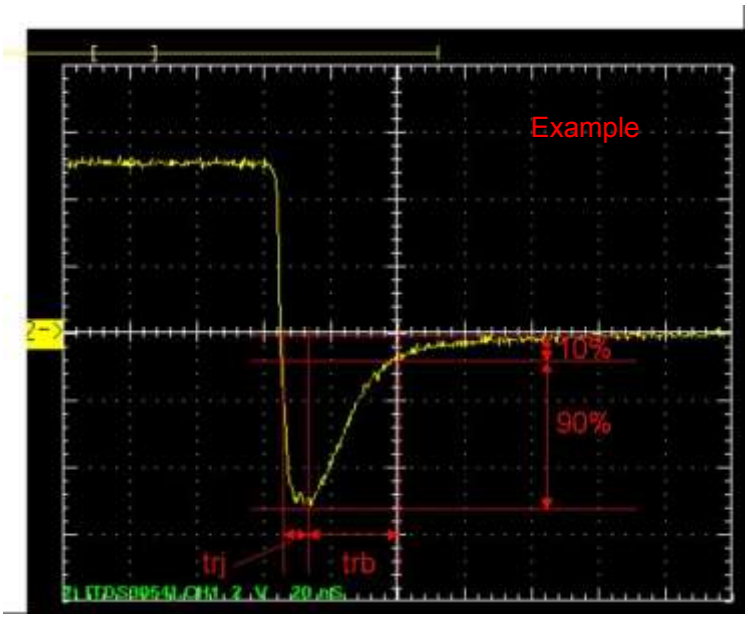
Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(ns)	416.000	416.536	0.129
trb(ns)	264.000	263.071	-0.352
trr(ns)	680.000	679.607	-0.058

Reverse Recovery Characteristic Reference



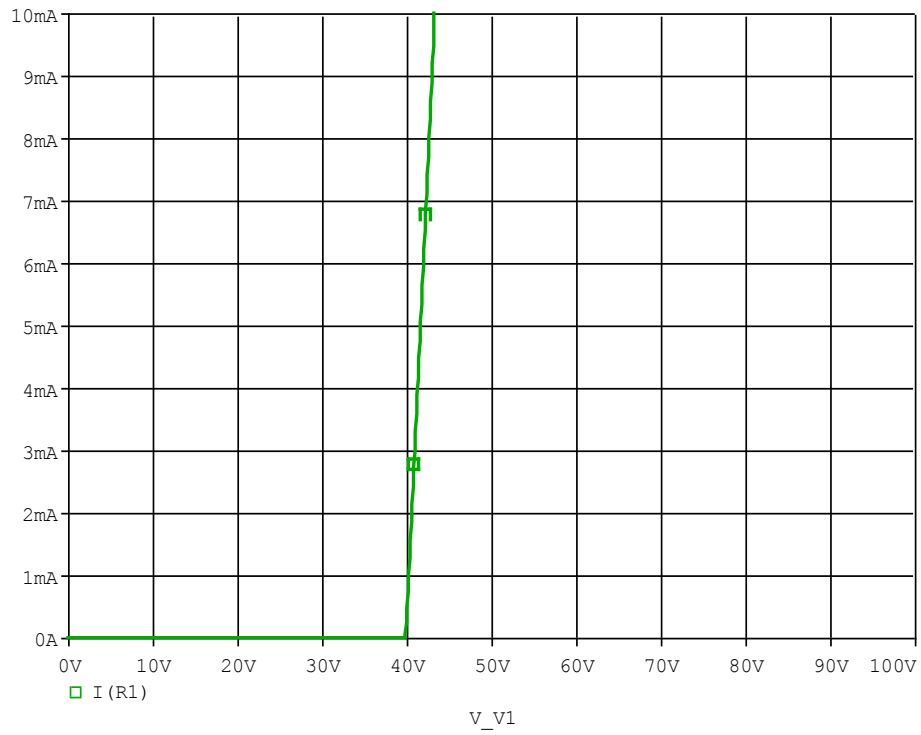
Trj=416(ns)
Trb=264(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



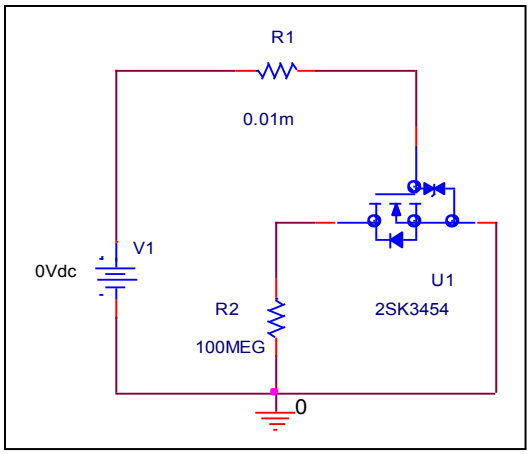
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference