Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SK3843
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

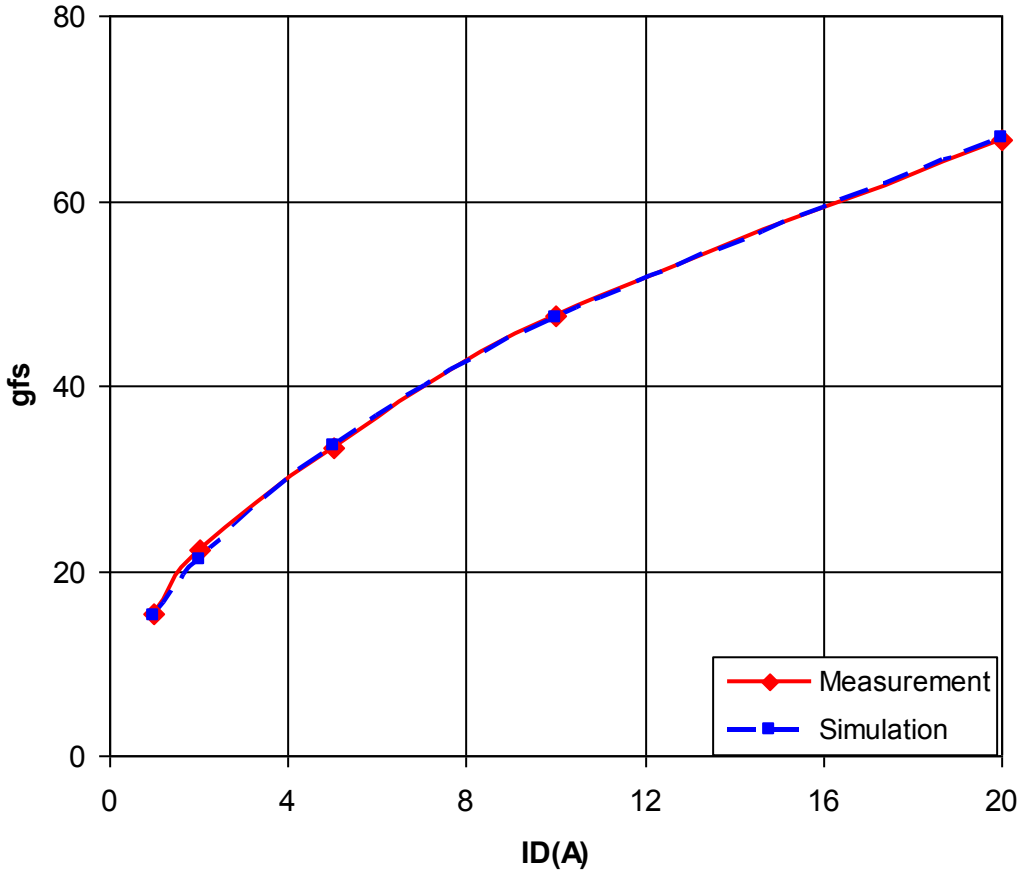
Bee Technologies Inc.

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	Mobility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Transconductance Characteristic

Circuit Simulation Result

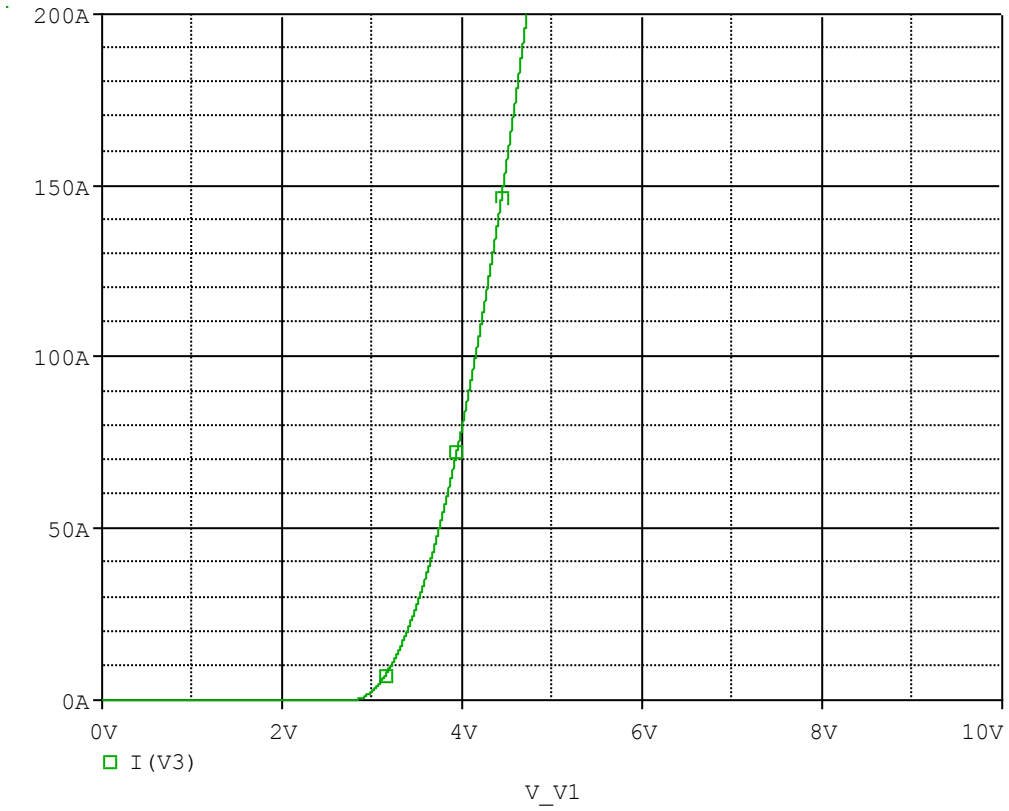


Comparison table

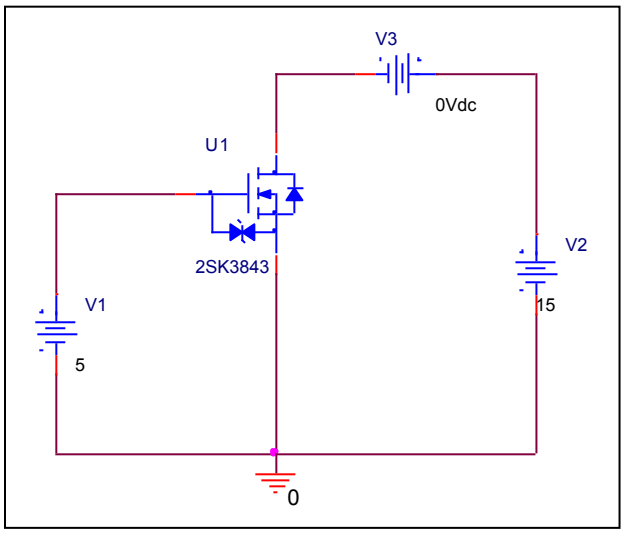
Id(A)	gfs		Error (%)
	Measurement	Simulation	
1	15.625	15.152	-3.027
2	22.222	21.277	-4.253
5	33.333	33.557	0.672
10	47.619	47.393	-0.475
20	66.667	66.890	0.334

Vgs-Id Characteristic

Circuit Simulation result

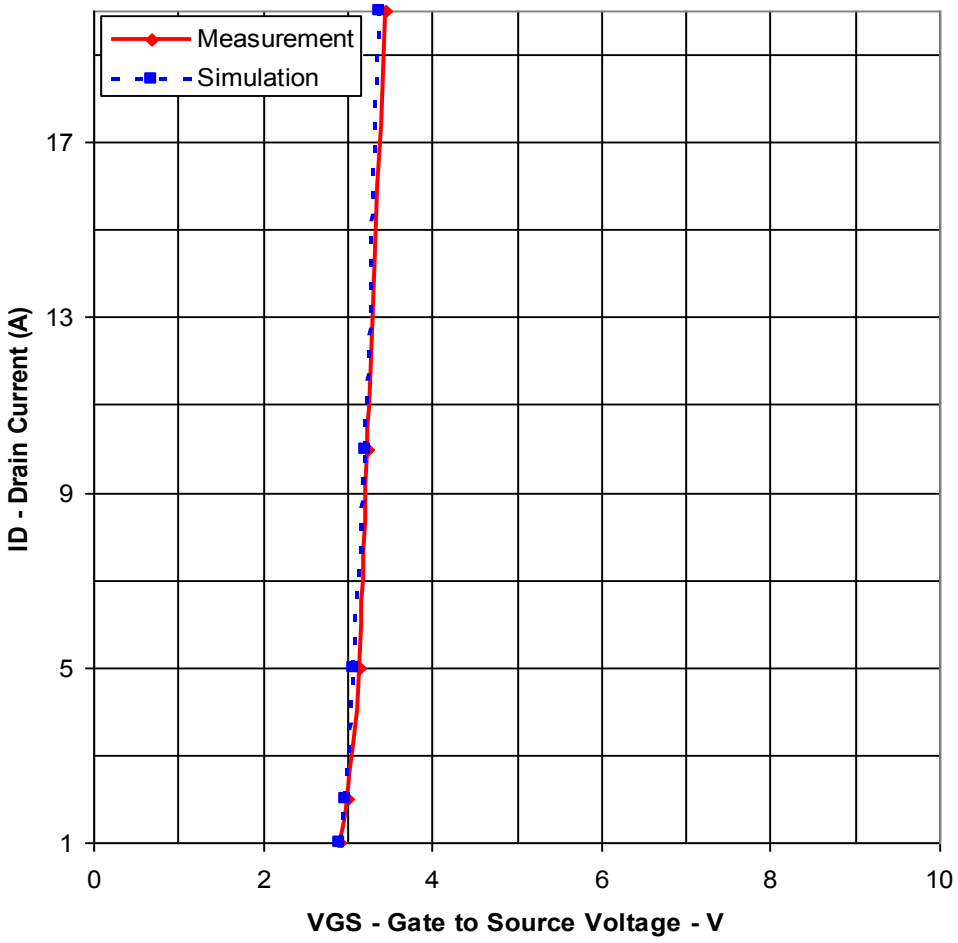


Evaluation circuit



Comparison Graph

Circuit Simulation Result

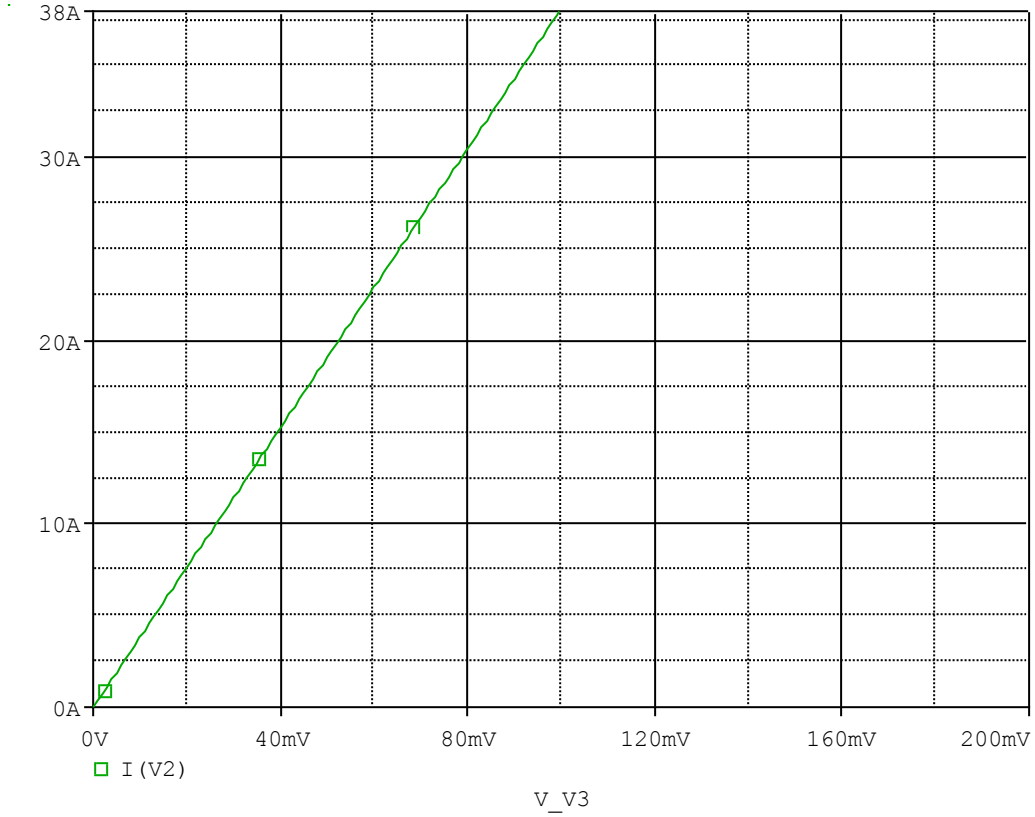


Simulation Result

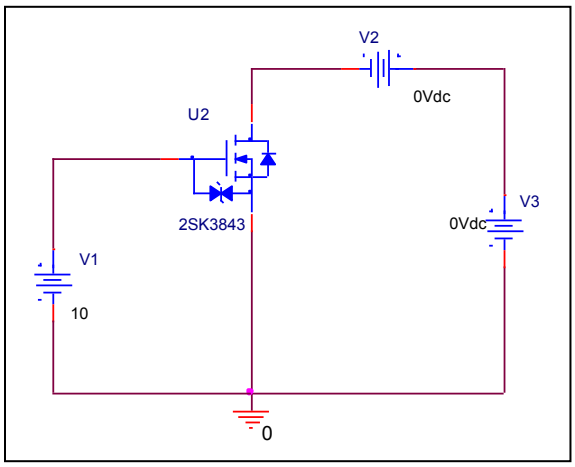
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
1	2.9	2.9145	0.500
2	3	2.9708	-0.973
5	3.15	3.0828	-2.133
10	3.25	3.2091	-1.258
20	3.45	3.3880	-1.797

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

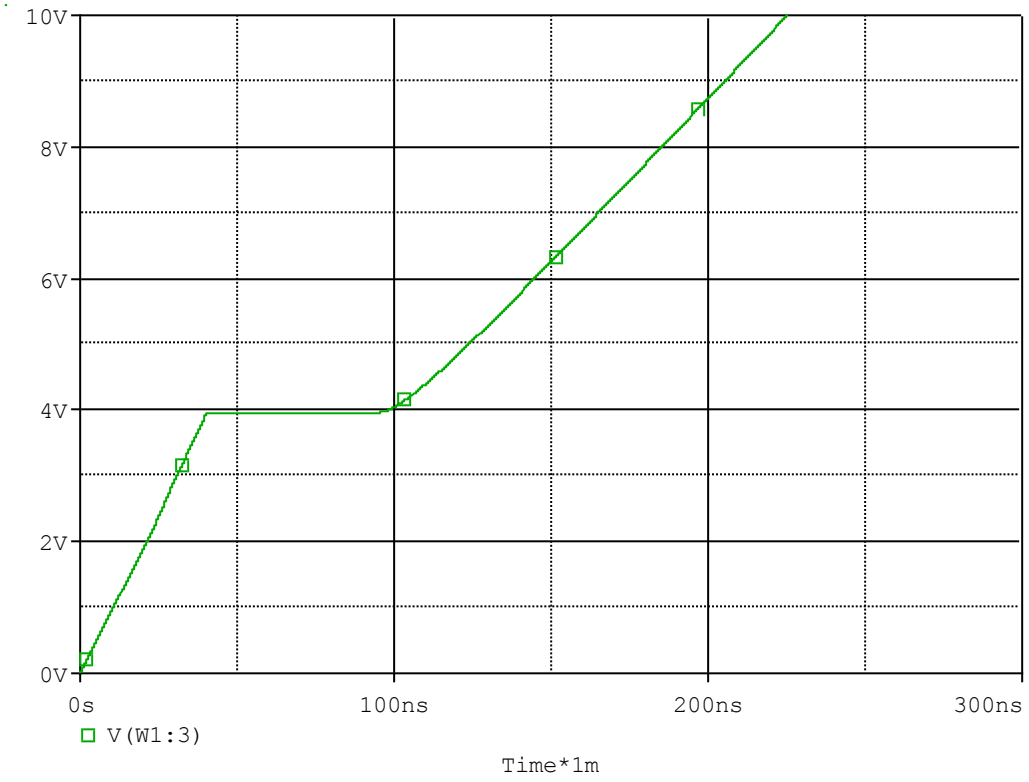


Simulation Result

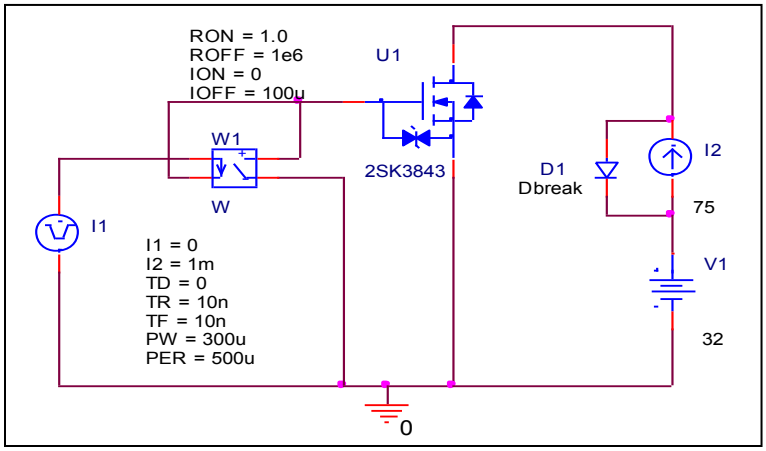
I_D=38A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	2.7	mΩ	2.623	Ω	-2.852

Gate Charge Characteristic

Circuit Simulation result



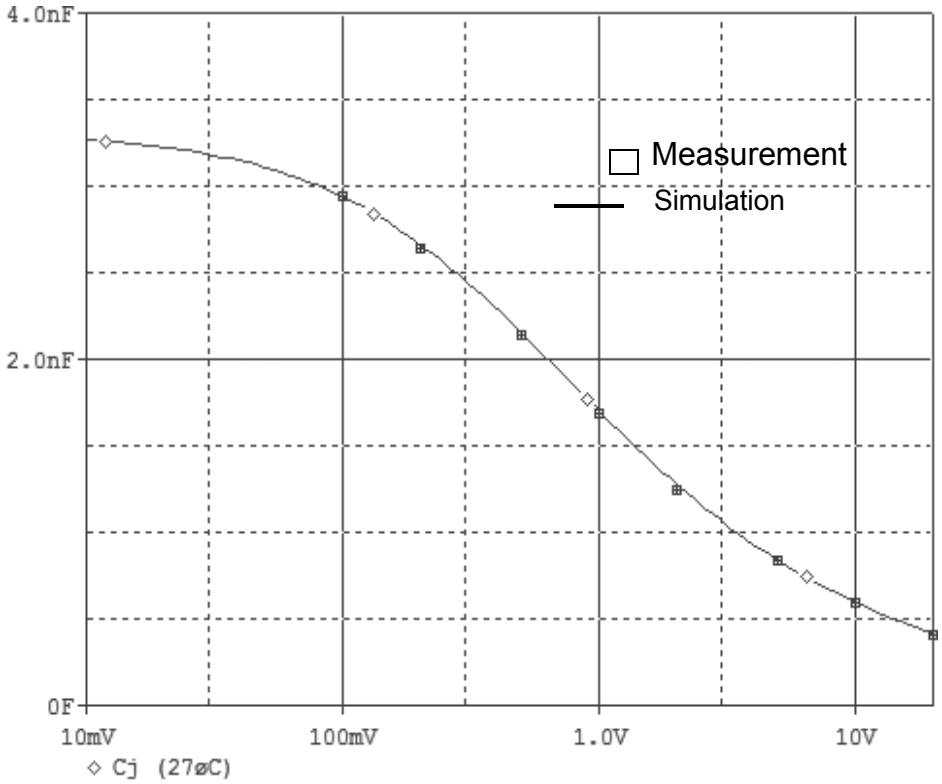
Evaluation circuit



Simulation Result

V_{DD}=32V,I_D=75A	Measurement		Simulation		Error (%)
Qgs	40	nC	40.430	nC	1.075
Qgd	55	nC	54.398	nC	-1.095
Qg	225	nC	225.285	nC	0.127

Capacitance Characteristic

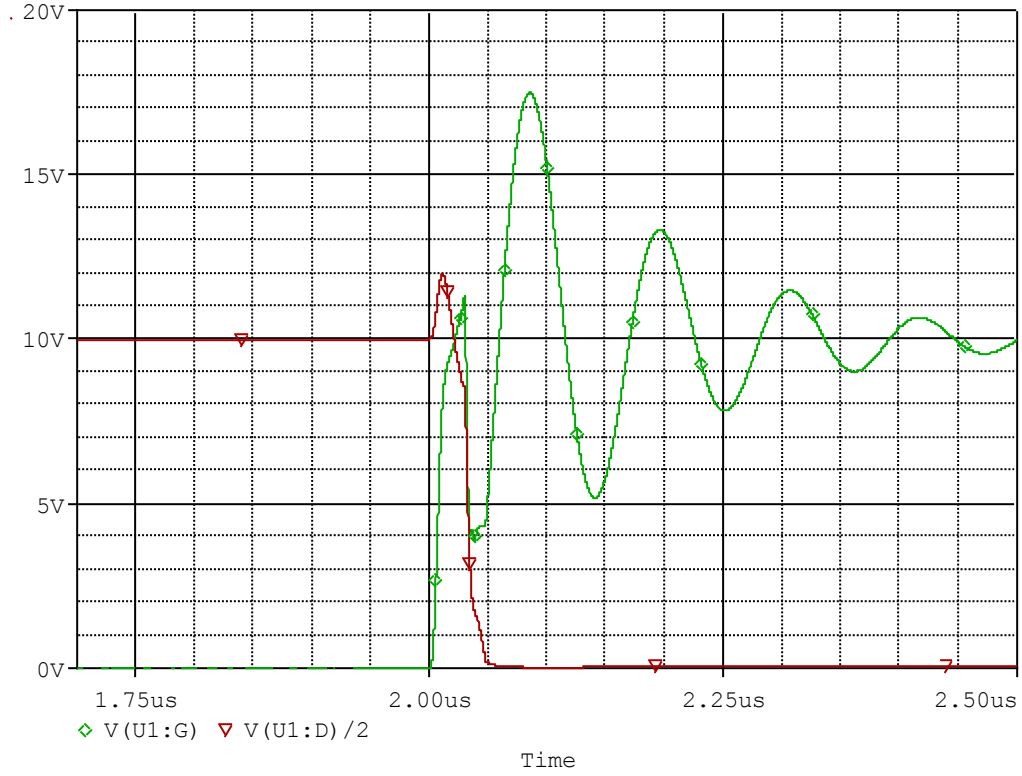


Simulation Result

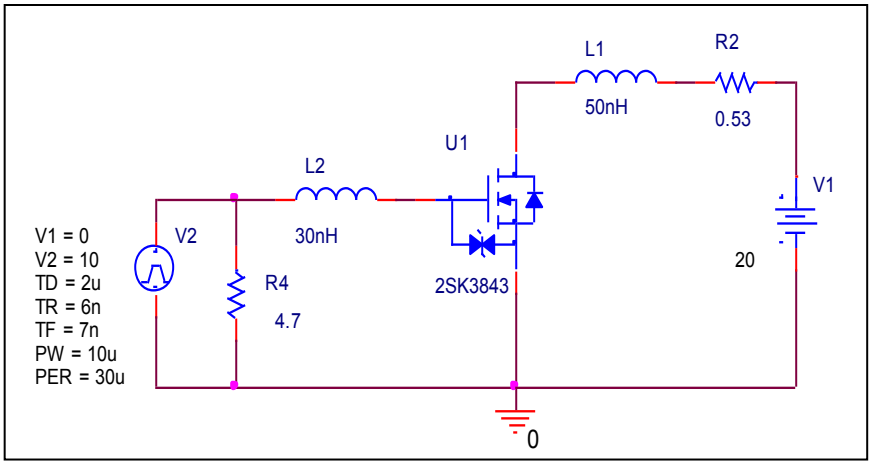
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	2950	2935	-0.508
0.2	2650	2675	0.943
0.5	2150	2140	-0.465
1	1700	1702	0.118
2	1250	1280	2.400
5	850	835	-1.765
10	600	590	-1.667
20	420	415	-1.190

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

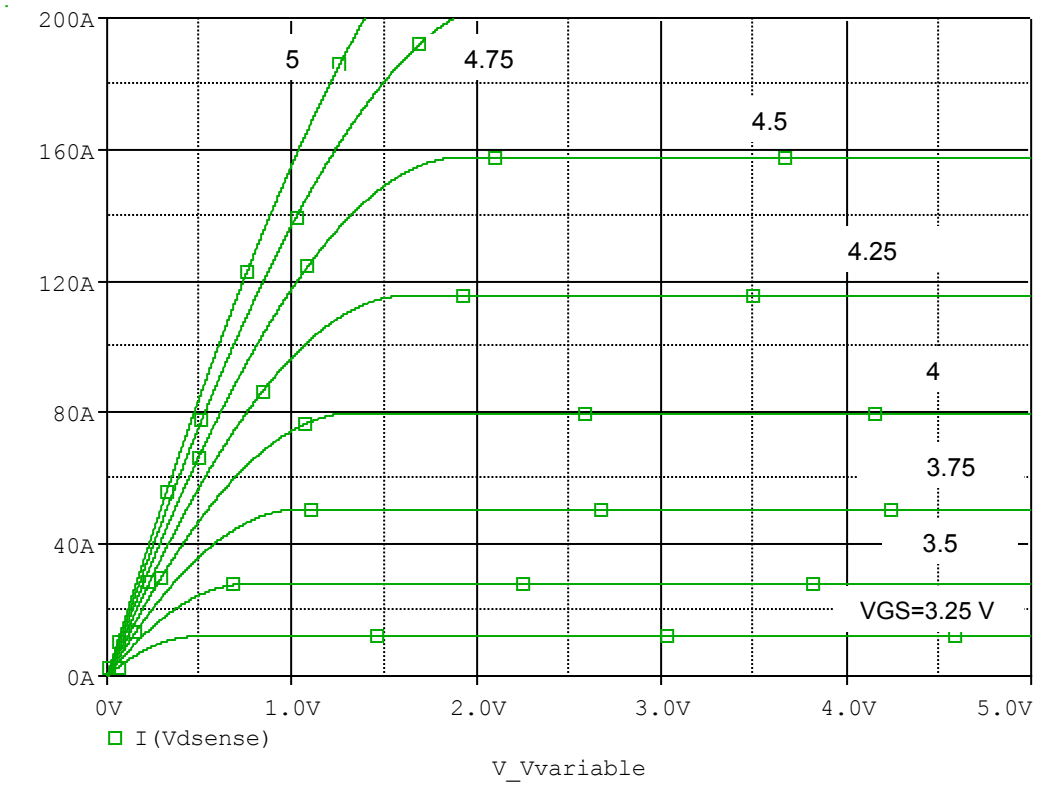


Simulation Result

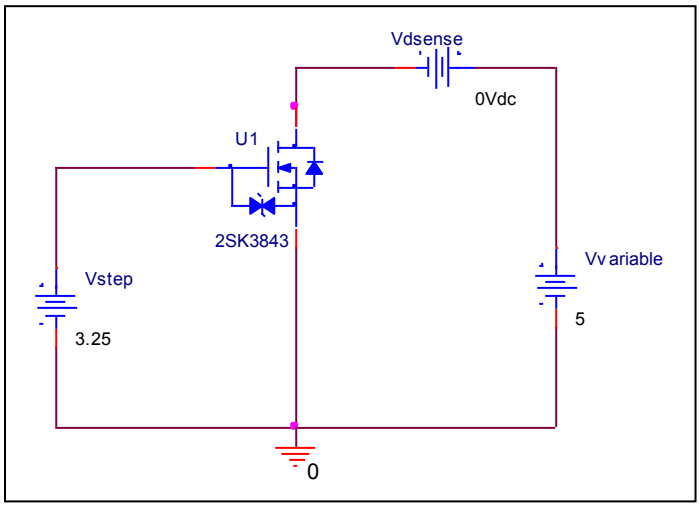
I_D=38 A, V_{DD}=20V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	40.000	ns	40.188	ns	0.47

Output Characteristic

Circuit Simulation result

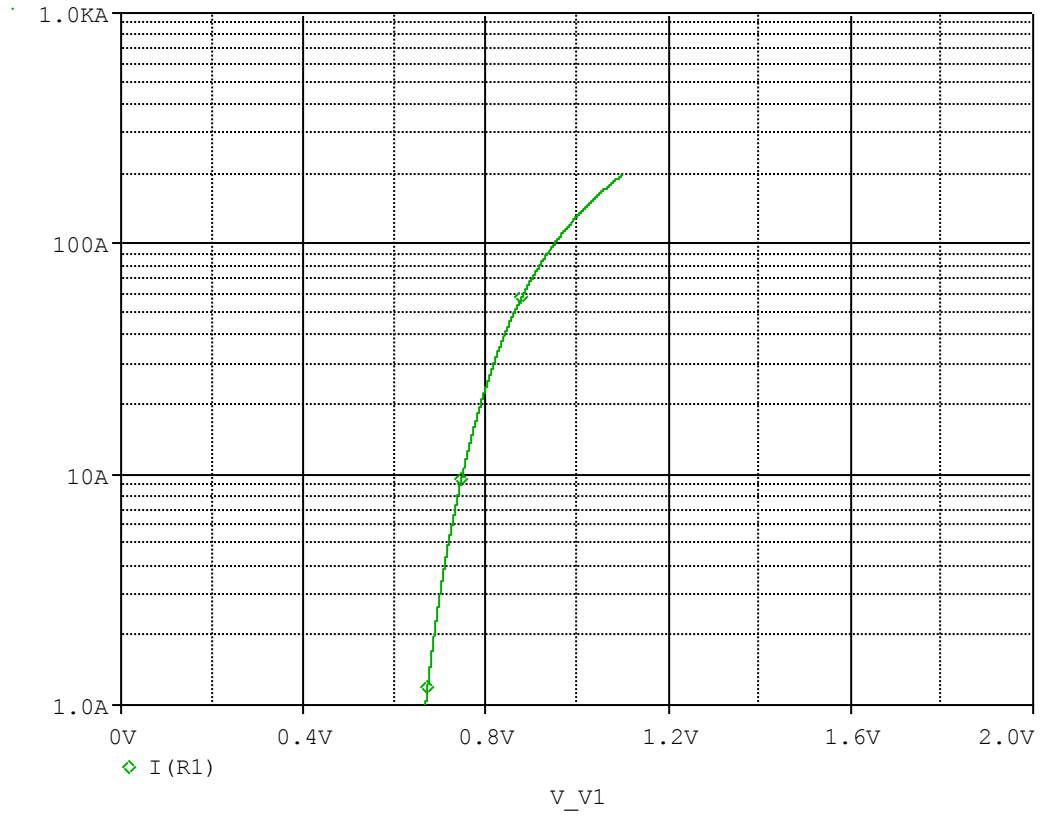


Evaluation circuit

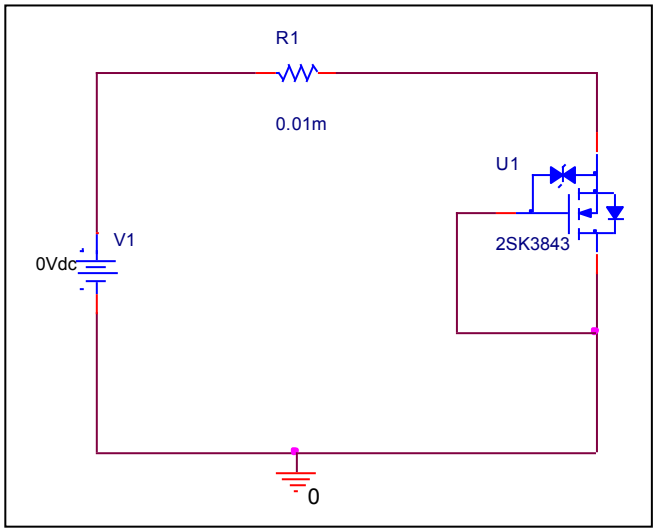


Forward Current Characteristic

Circuit Simulation Result

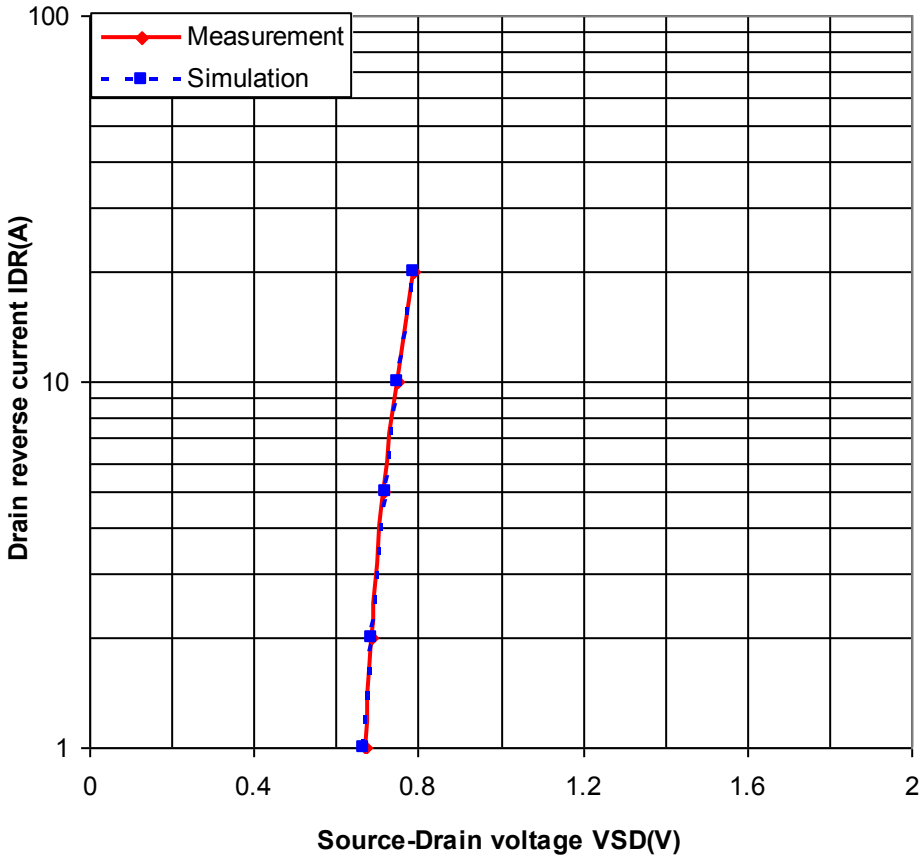


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

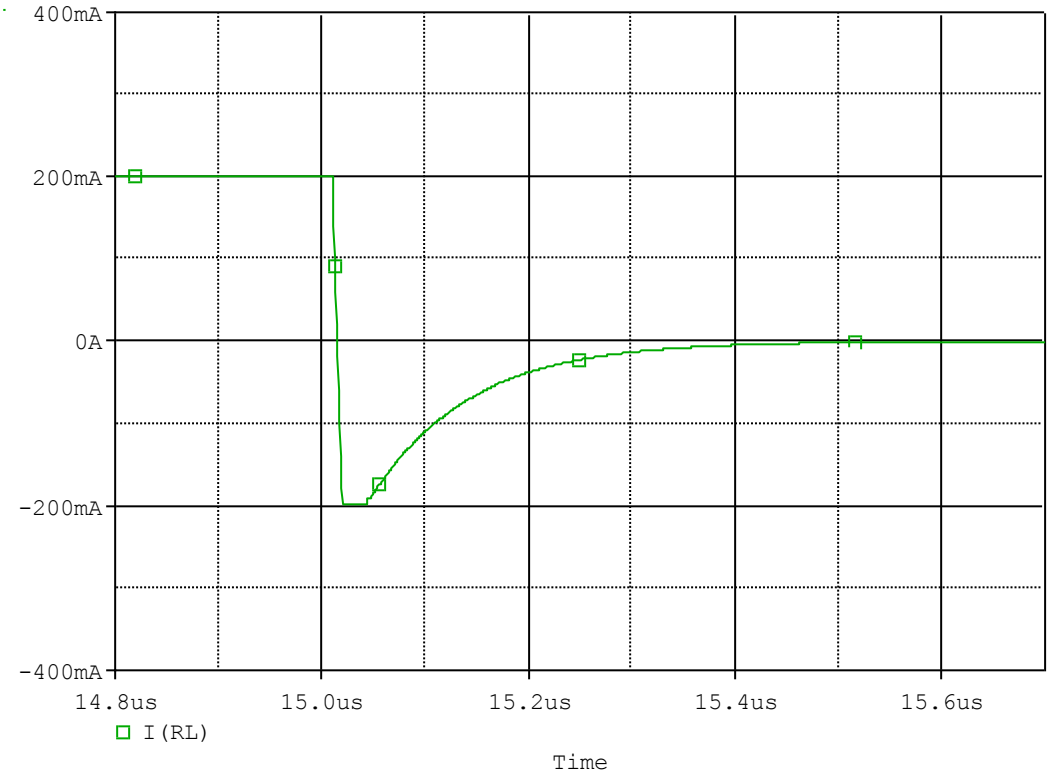


Simulation Result

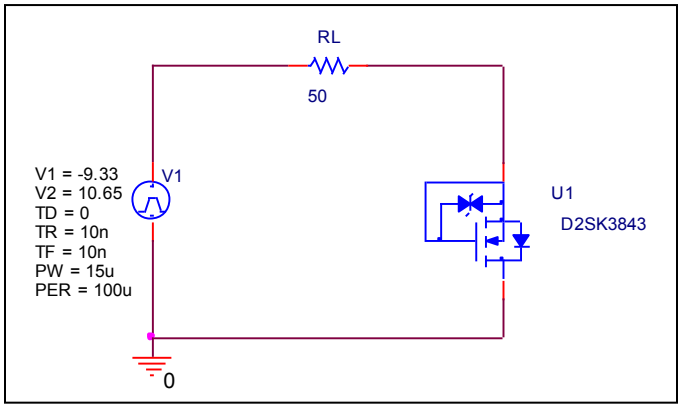
Ifwd(A)	VSD(V)		%Error
	Measurement	Simulation	
1	0.67	0.668	-0.299
2	0.685	0.687	0.292
5	0.715	0.718	0.420
10	0.75	0.749	-0.133
20	0.79	0.788	-0.253

Reverse Recovery Characteristic

Circuit Simulation Result



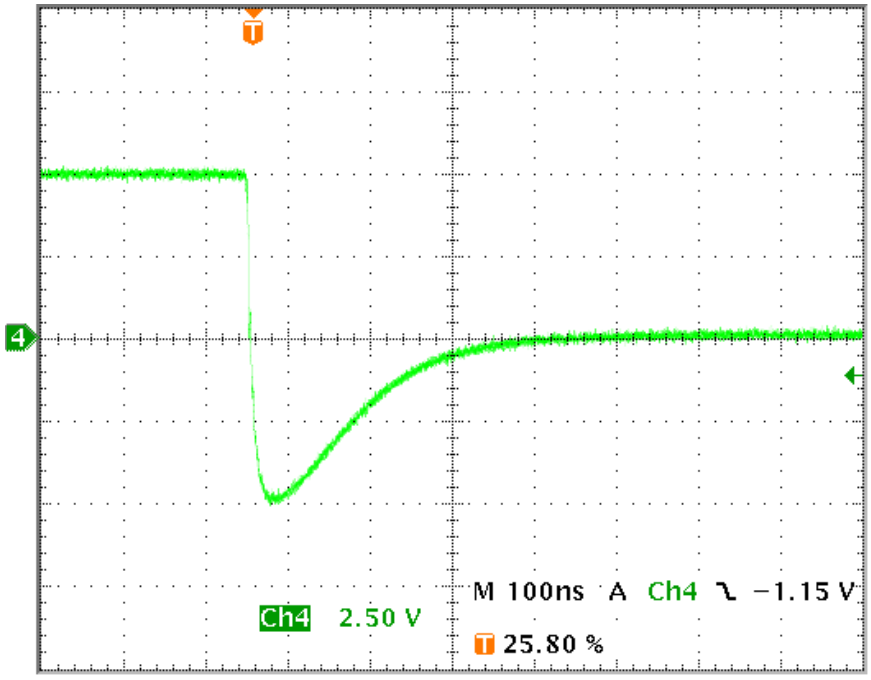
Evaluation Circuit



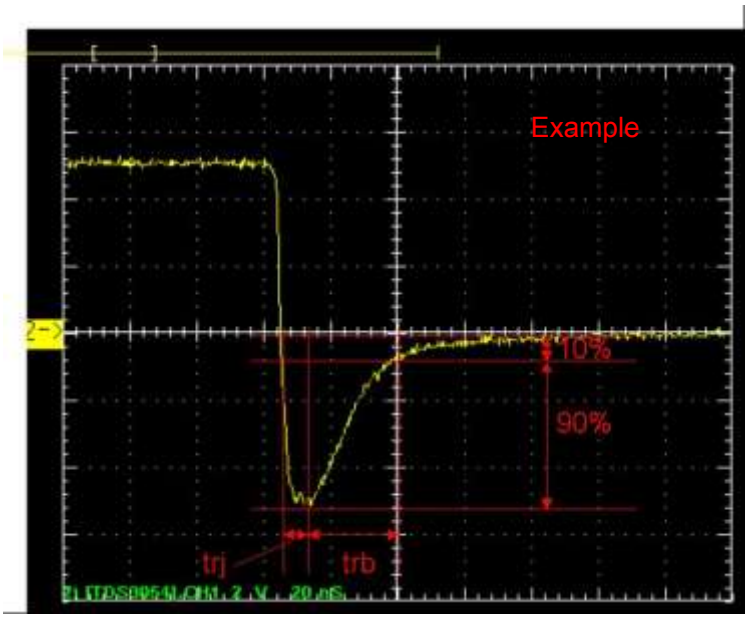
Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(ns)	**26**	**26.032**	**0.123**
Trb(ns)	**220**	**219.361**	**-0.290**
Trr(ns)	**246**	**245.393**	**-0.247**

Reverse Recovery Characteristic Reference



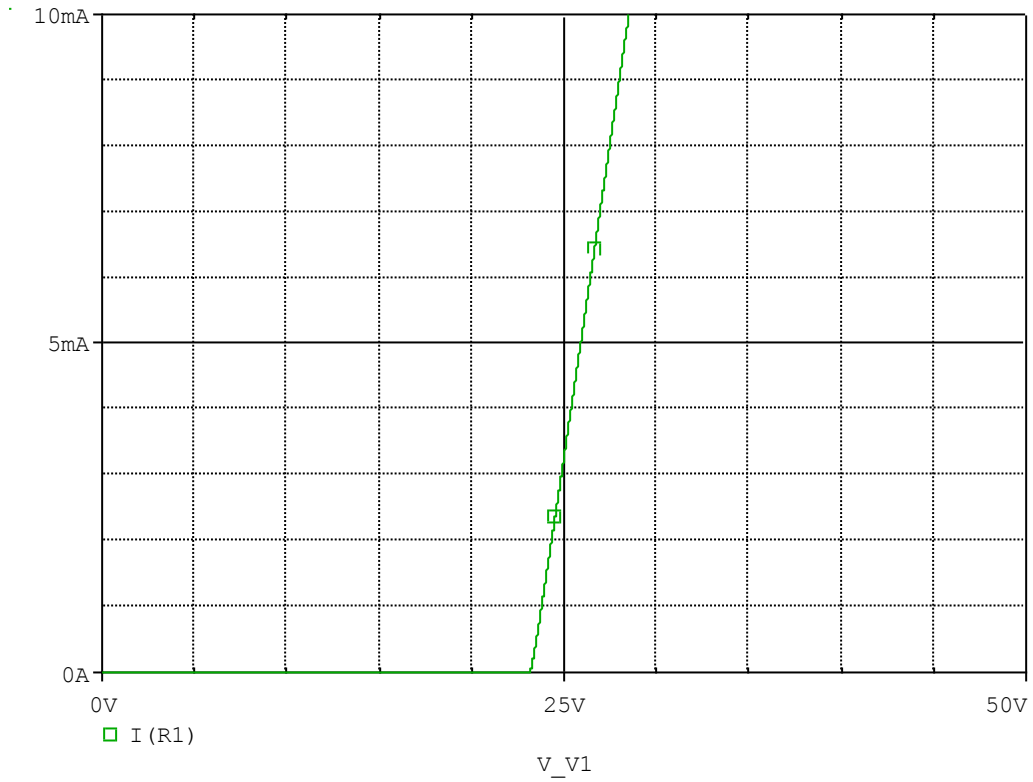
Trj=26(ns)
Trb=220(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



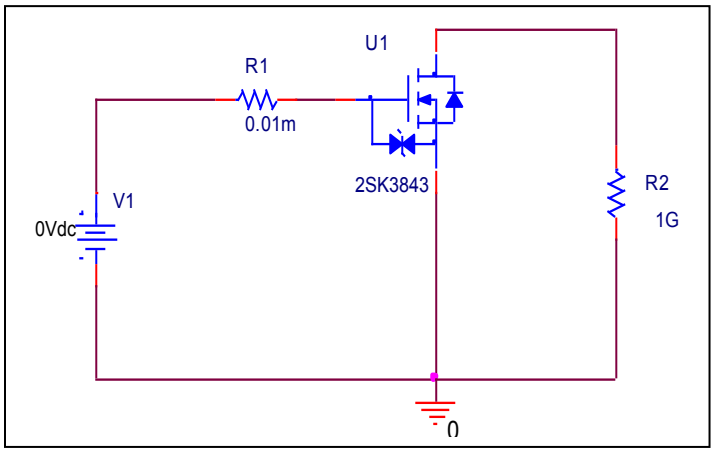
Relation between trj and trb

ESD PROTECTION DIODE
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference