Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SK2601
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

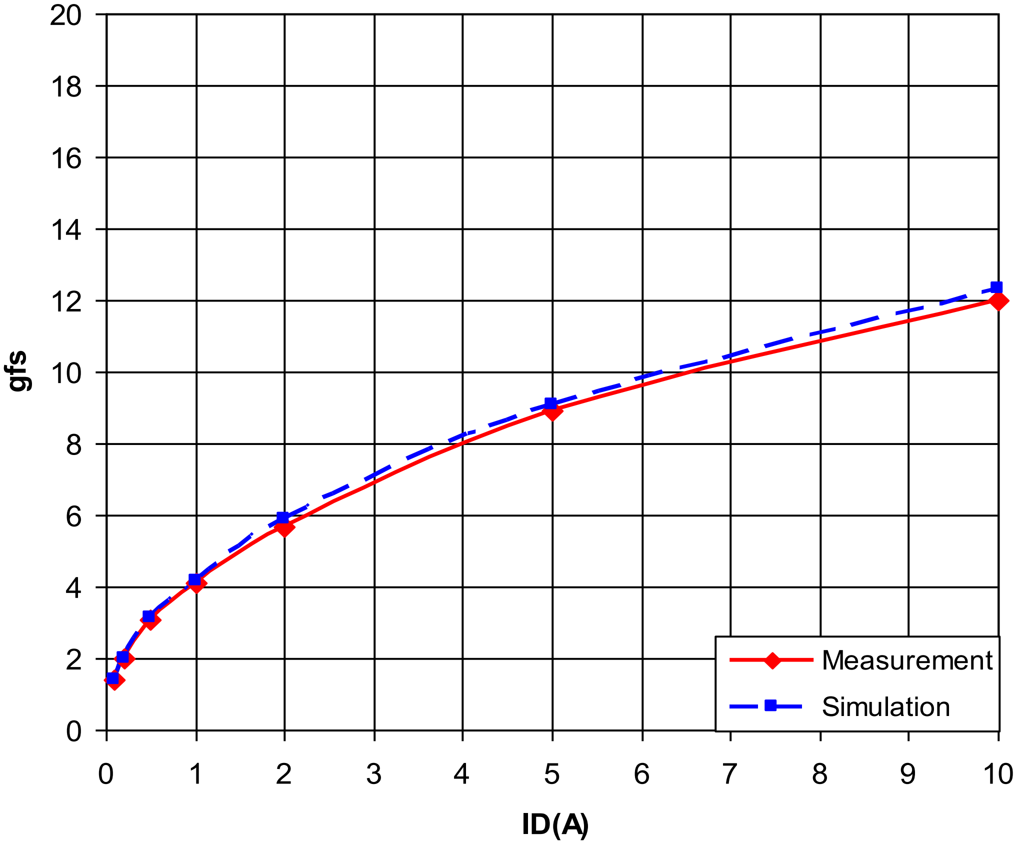
Bee Technologies Inc.

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

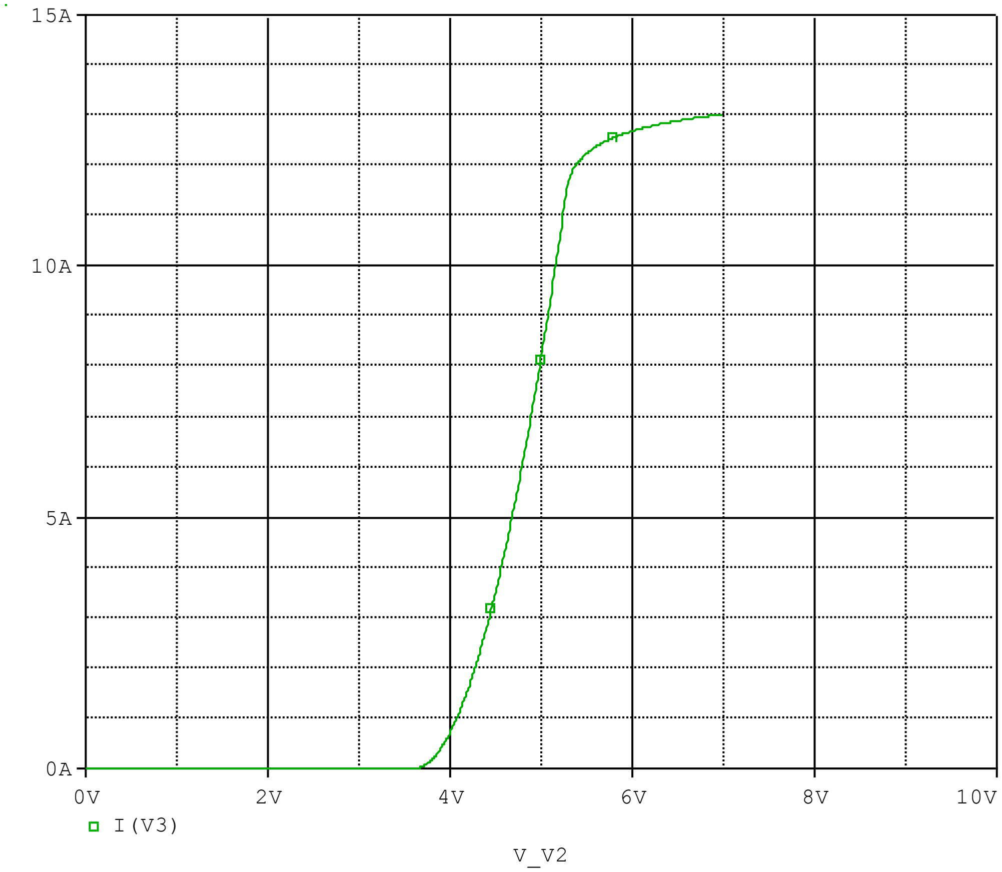


Comparison table

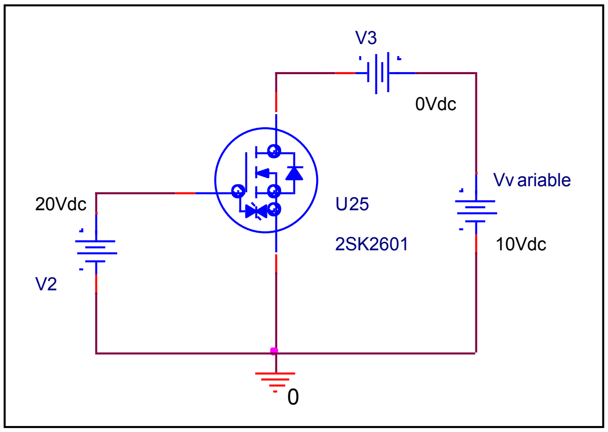
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	1.400	1.429	2.071
0.2	2.000	2.000	0.000
0.5	3.100	3.125	0.806
1	4.100	4.167	1.634
2	5.700	5.882	3.193
5	8.900	9.091	2.146
10	12.000	12.346	2.883

Vgs-Id Characteristic

Circuit Simulation result

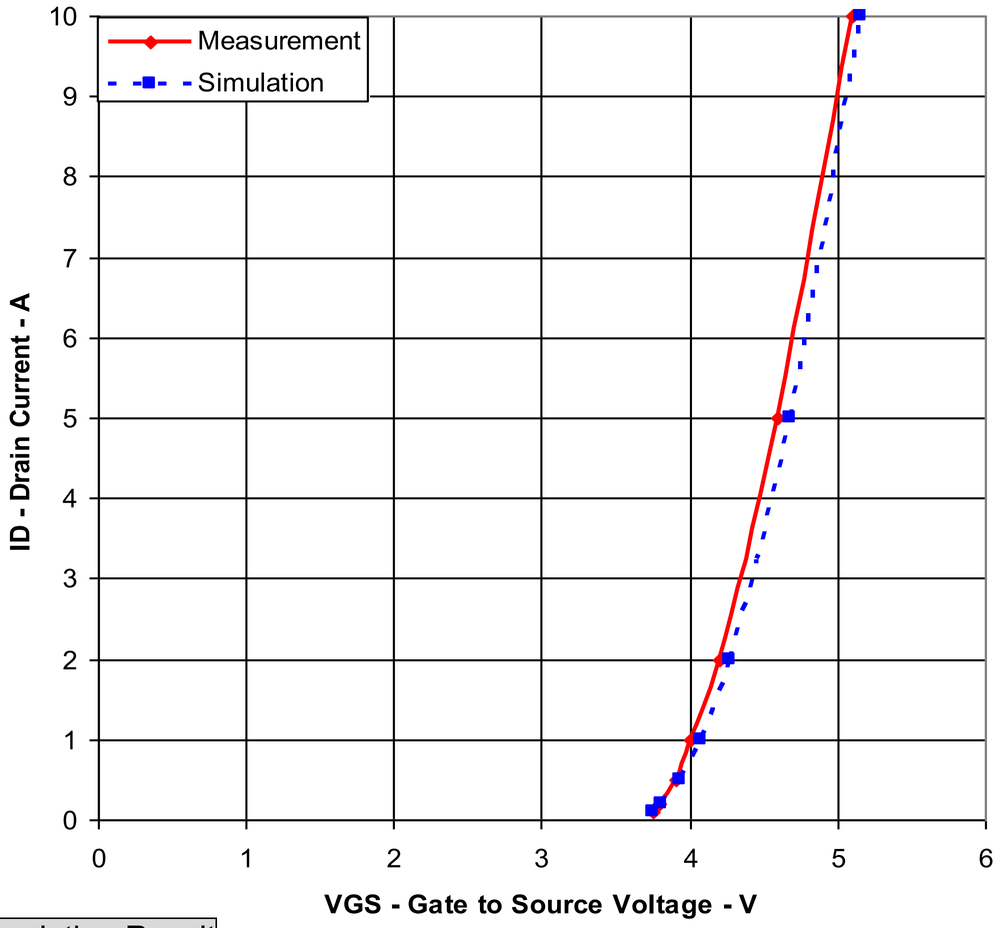


Evaluation circuit



Comparison Graph

Circuit Simulation Result

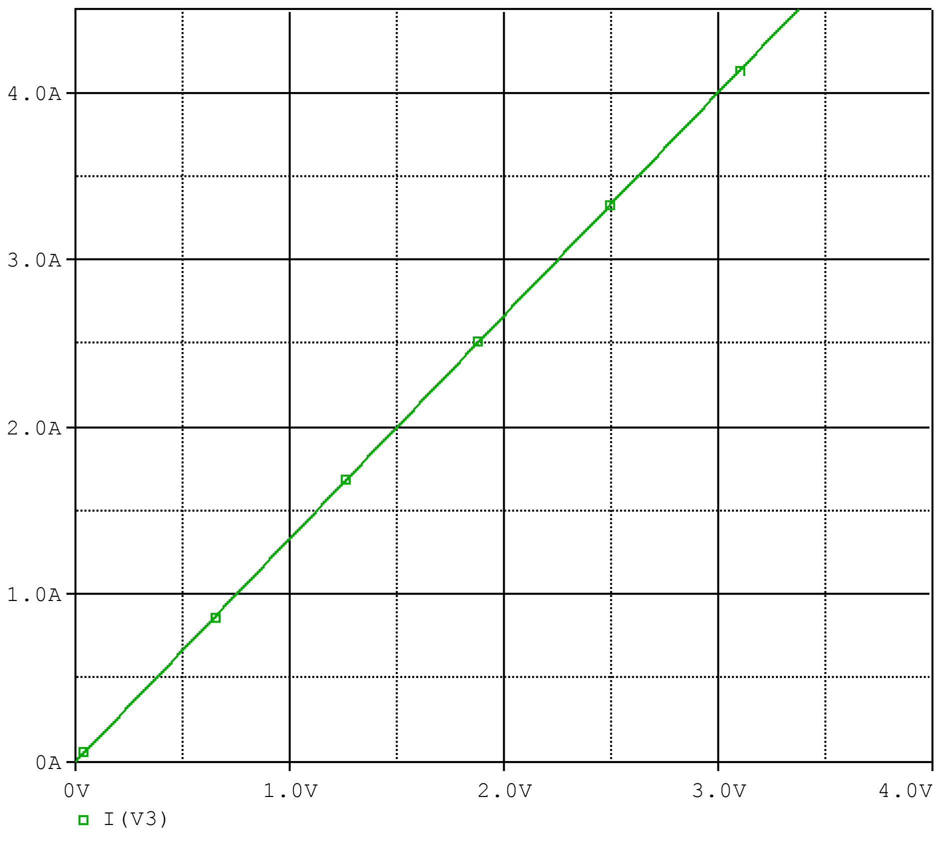


Simulation Result

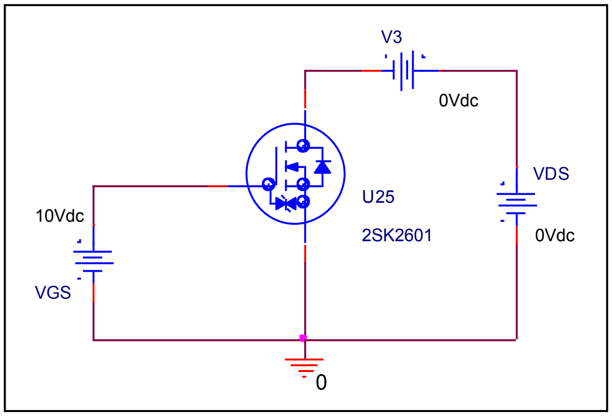
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.1	3.750	3.750	0.000
0.2	3.800	3.811	0.289
0.5	3.900	3.933	0.846
1	4.000	4.072	1.800
2	4.200	4.272	1.714
5	4.600	4.680	1.739
10	5.100	5.156	1.098

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

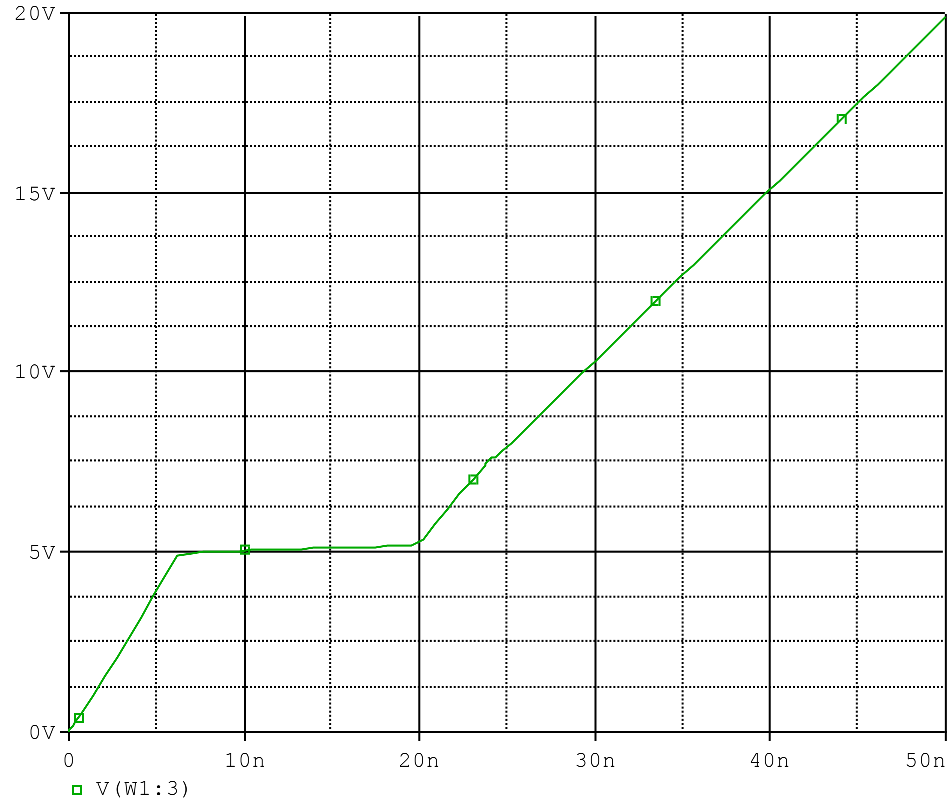


Simulation Result

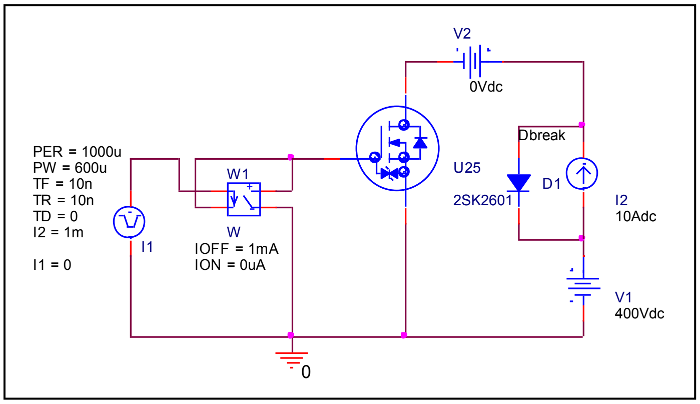
I_D=5A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	0.750	Ω	0.750	Ω	0

Gate Charge Characteristic

Circuit Simulation result



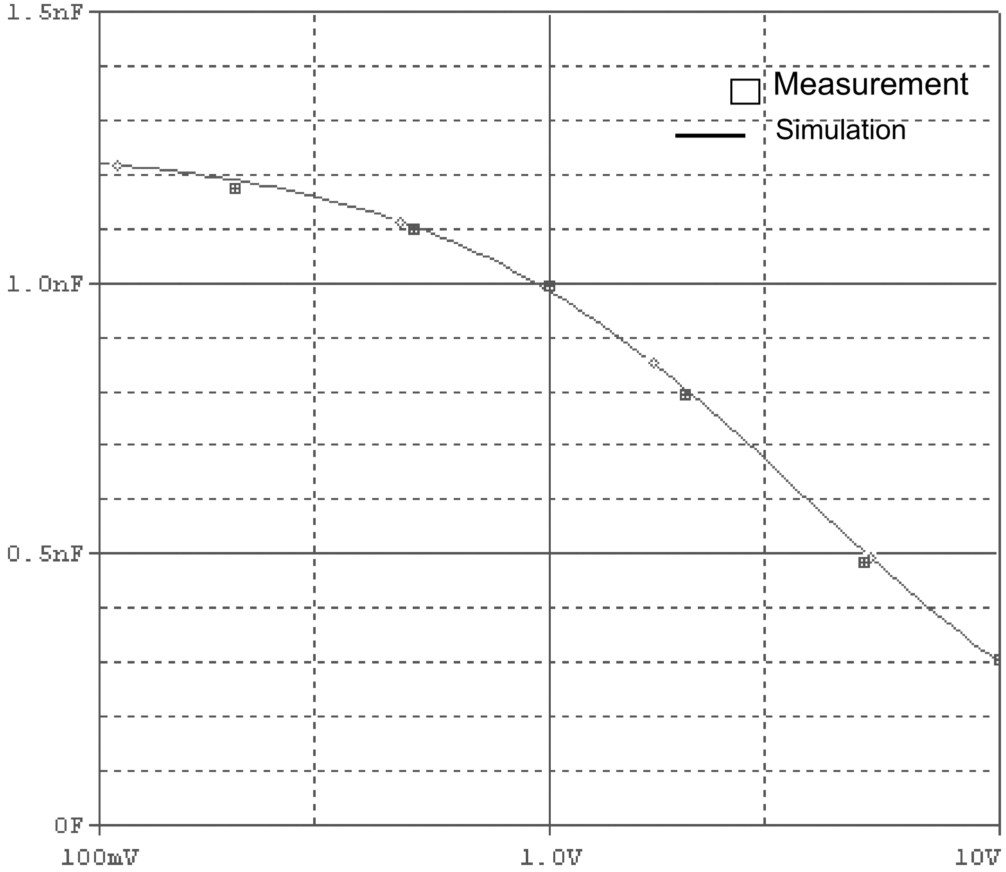
Evaluation circuit



Simulation Result

V_{DD}=400V,I_D=8A ,V_{GS}=10V	Measurement	Simulation	Error (%)
Qgs(nC)	6.000	6.220	3.667
Qgd(nC)	13.000	13.070	0.538
Qg	30.000	29.338	-2.207

Capacitance Characteristic

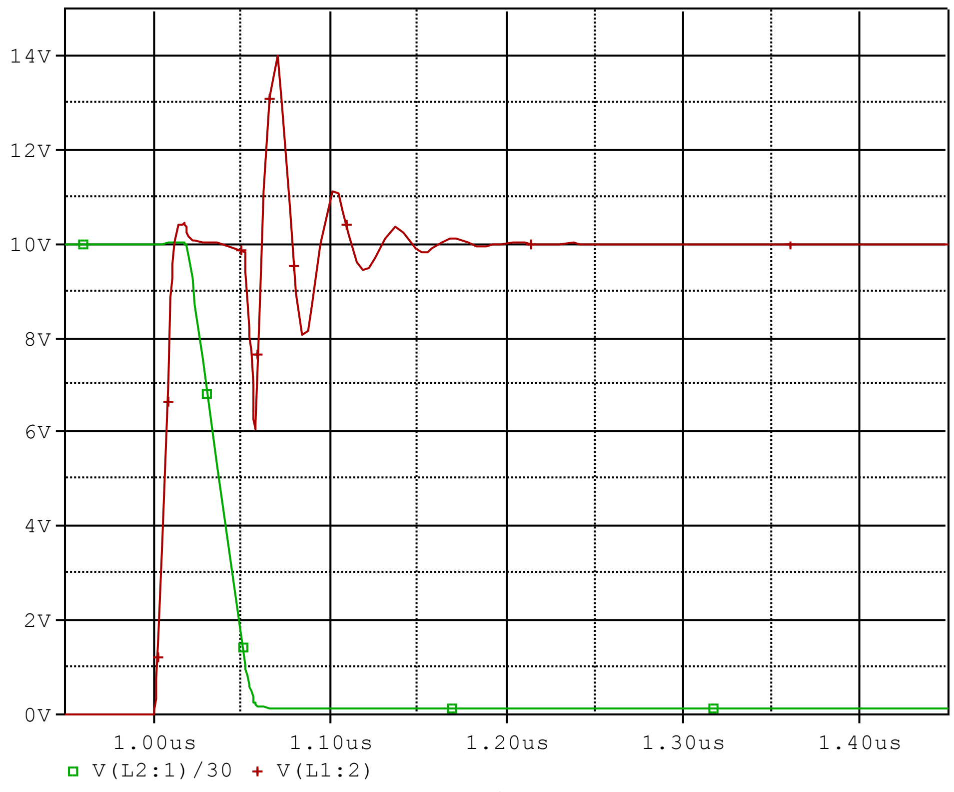


Simulation Result

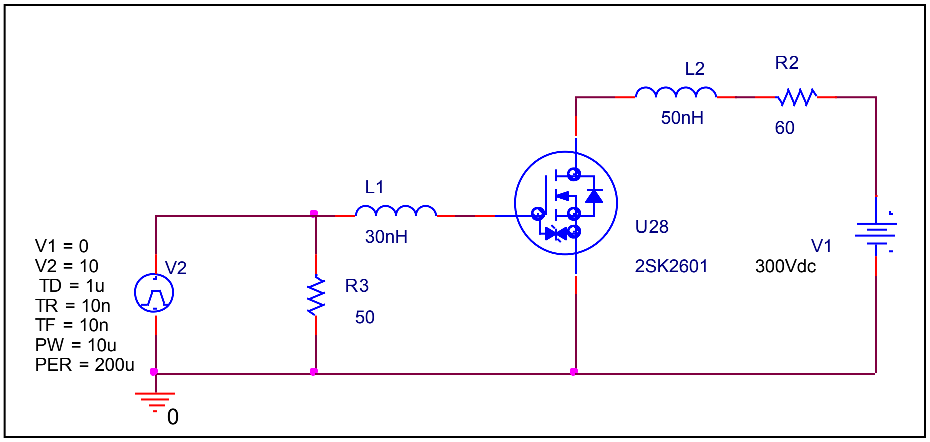
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.2	1170.000	1180.000	0.855
0.5	1110.000	1105.000	-0.450
1	1000.000	1000.000	0.000
2	795.000	800.000	0.629
5	485.000	490.000	1.031
10	300.000	310.000	3.333

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

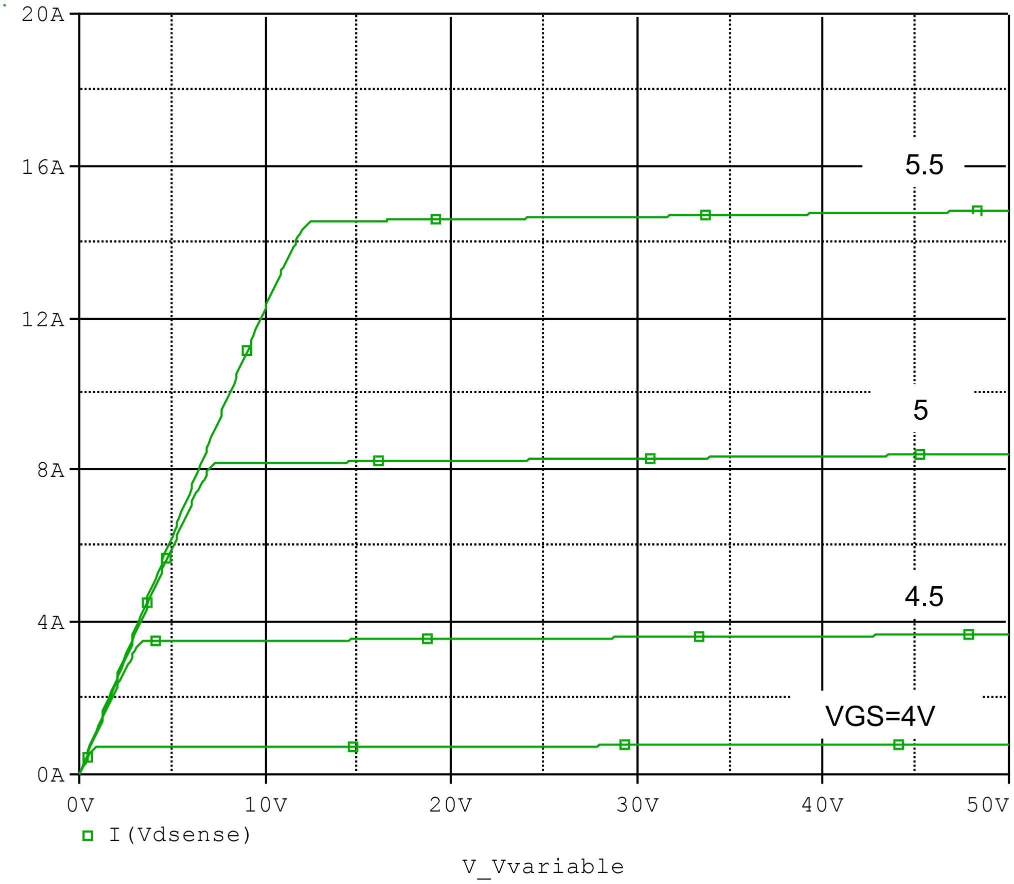


Simulation Result

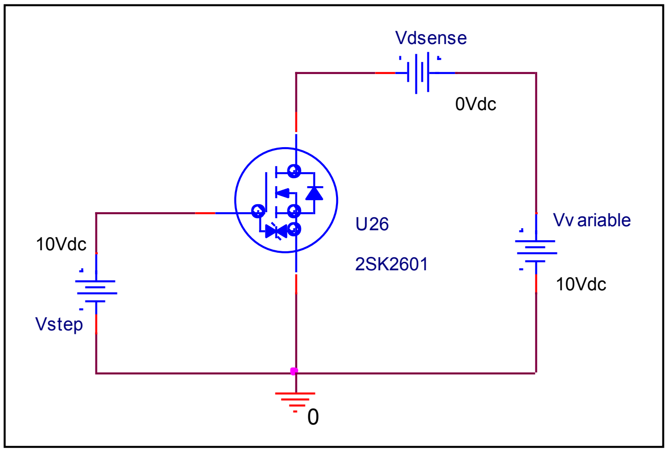
I_D=5A, V_{DD}=300V V_{GS}=0/10V	Measurement	Simulation	Error(%)
Ton(ns)	50.000	50.274	0.548

Output Characteristic

Circuit Simulation result

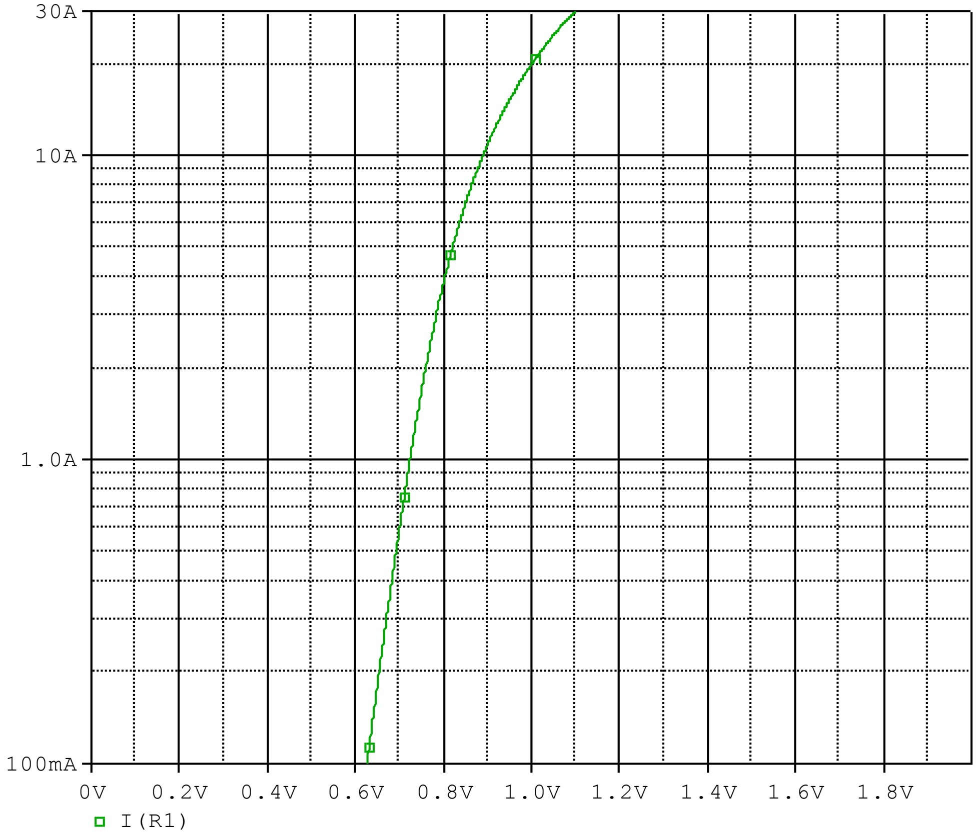


Evaluation circuit

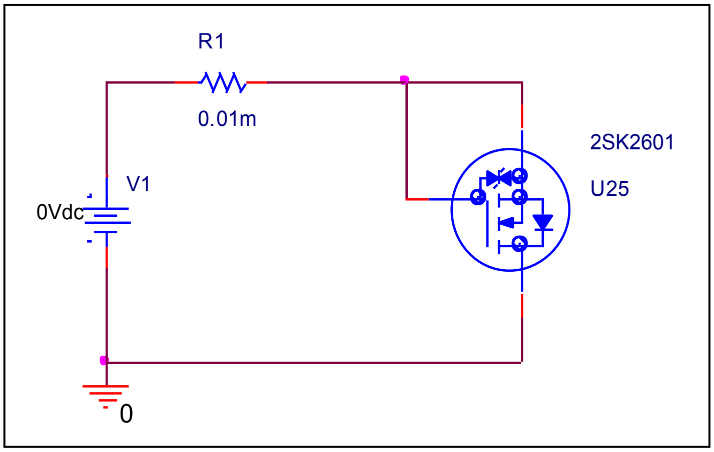


Forward Current Characteristic

Circuit Simulation Result

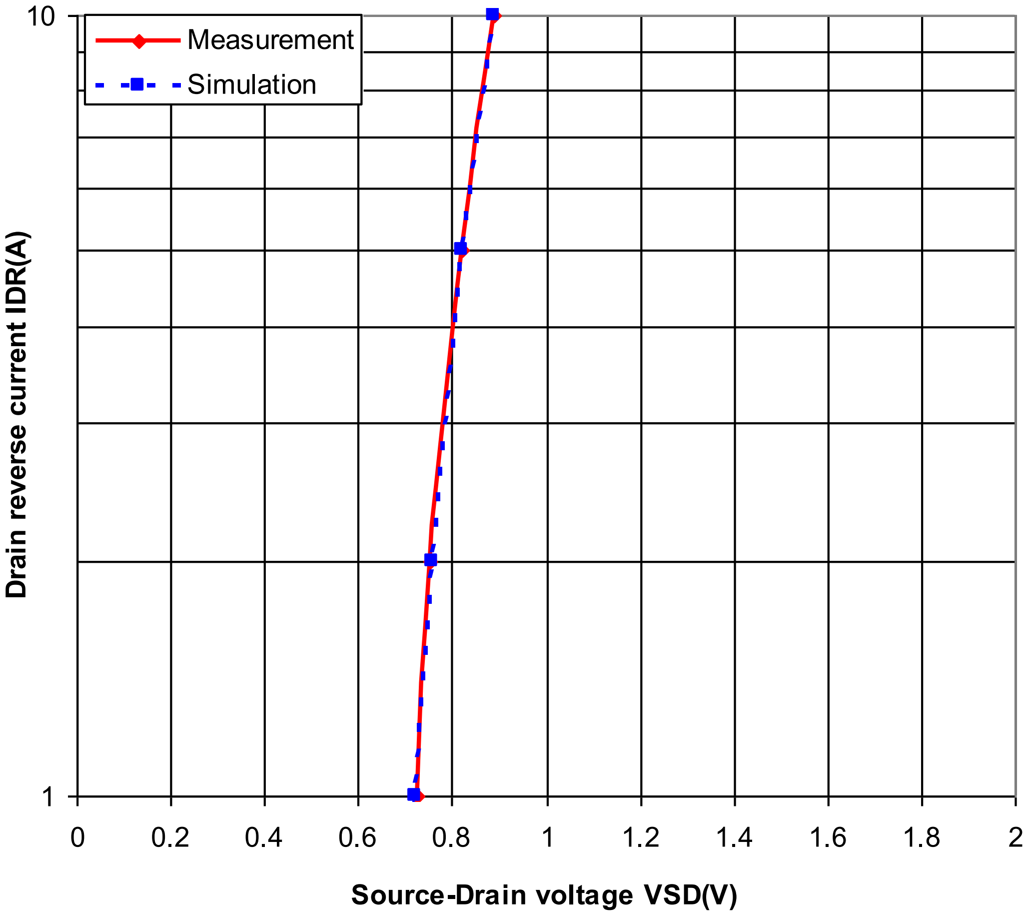


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

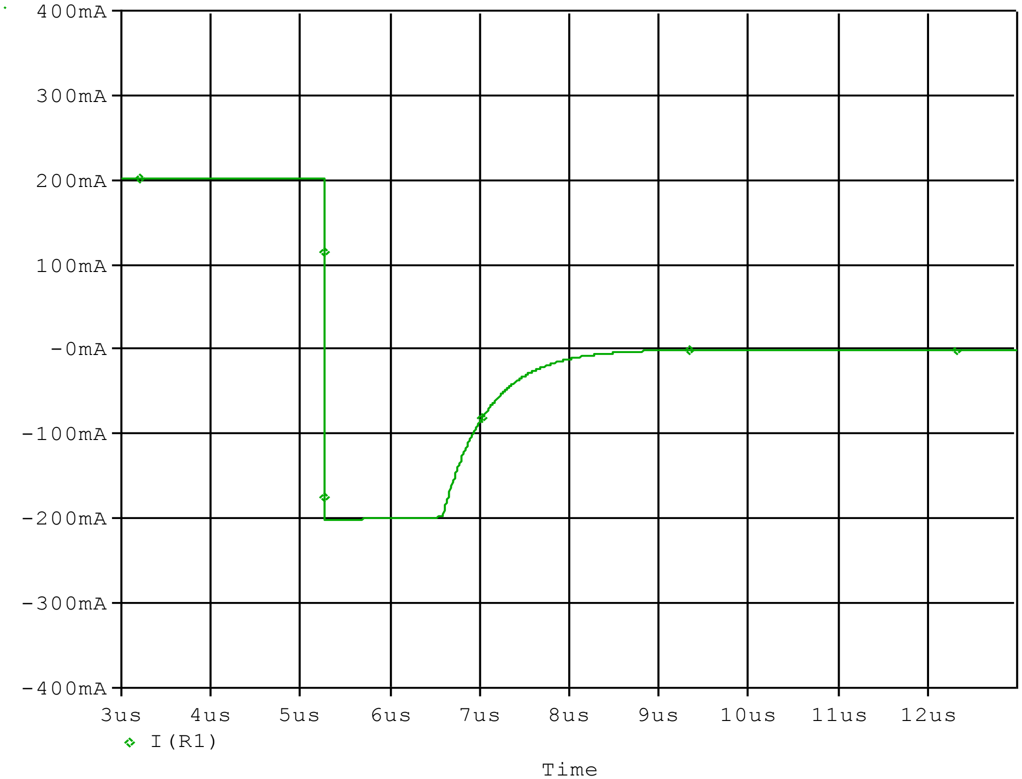


Simulation Result

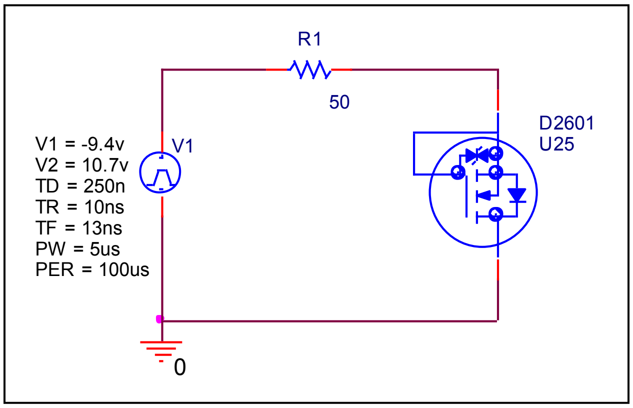
IDR(A)	VSD(V)		%Error
	Measuremen	Simulation	
0.1	0.620	0.625	0.806
0.2	0.660	0.654	-0.909
0.5	0.695	0.692	-0.432
1	0.725	0.723	-0.276
2	0.755	0.759	0.530
5	0.820	0.820	0.000
10	0.890	0.888	-0.225

Reverse Recovery Characteristic

Circuit Simulation Result



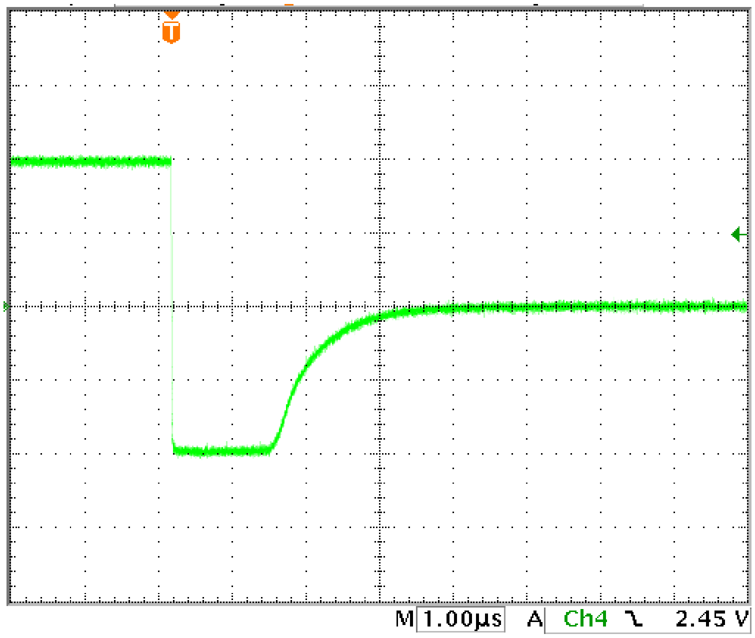
Evaluation Circuit



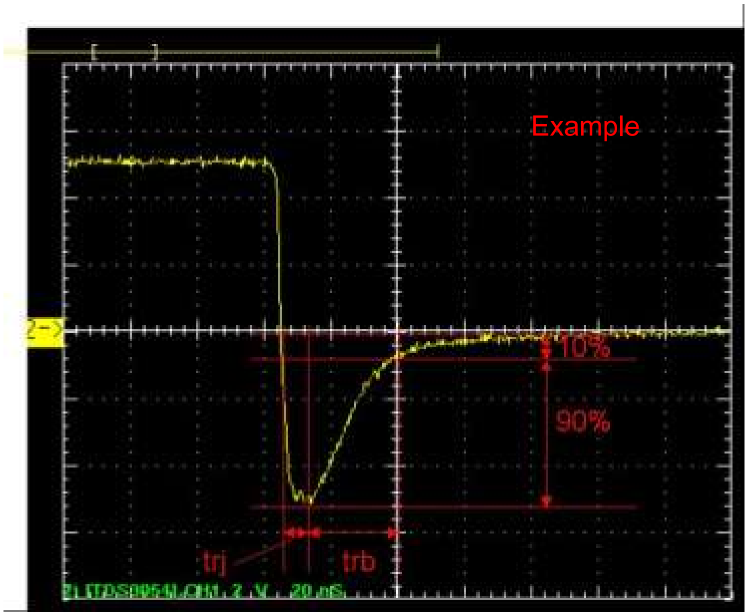
Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(us)	**1.250**	**1.251**	**0.080**
Trb(us)	**1.250**	**1.250**	**0.000**
Trr(us)	**2.500**	**2.501**	**0.040**

Reverse Recovery Characteristic Reference



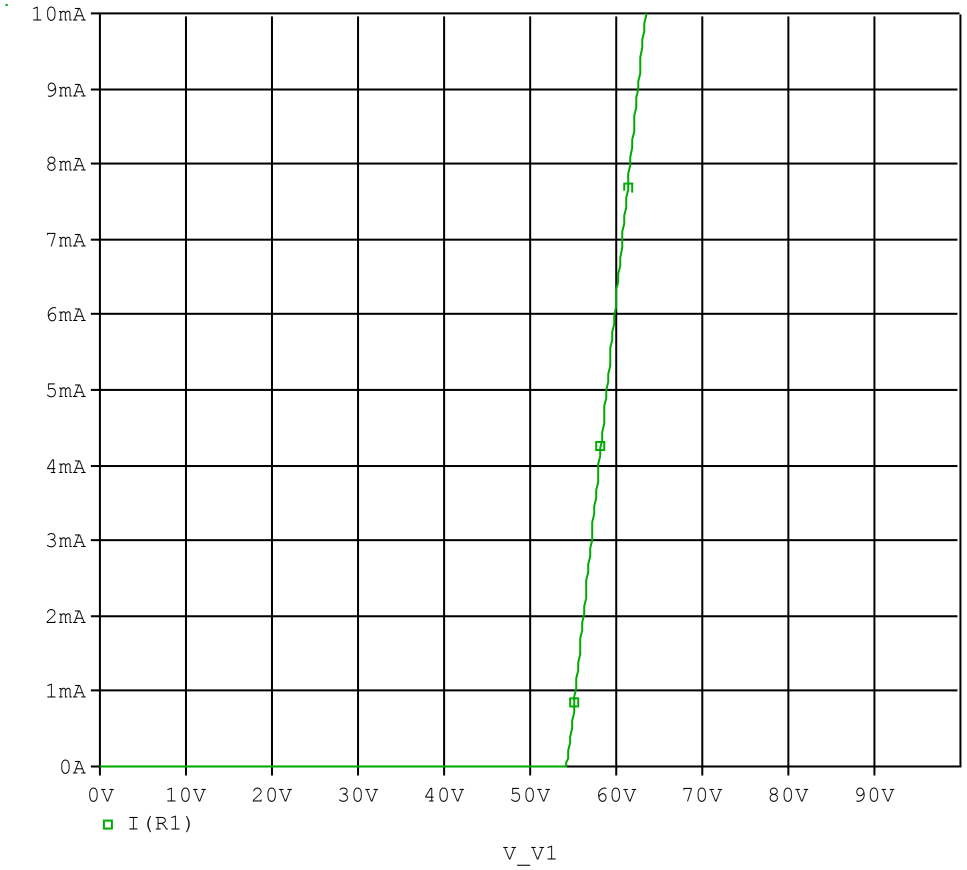
Trj=1.25(us)
Trb=1.25(us)
Conditions:Ifwd=Irev=0.2(A),Rl=50



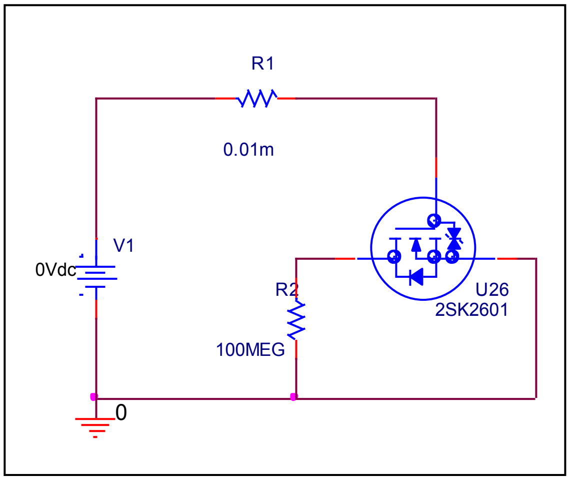
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference