

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: SPW11N60CFD
MANUFACTURER: Infineon technologies
REMARK: Body Diode (Special)



Bee Technologies Inc.

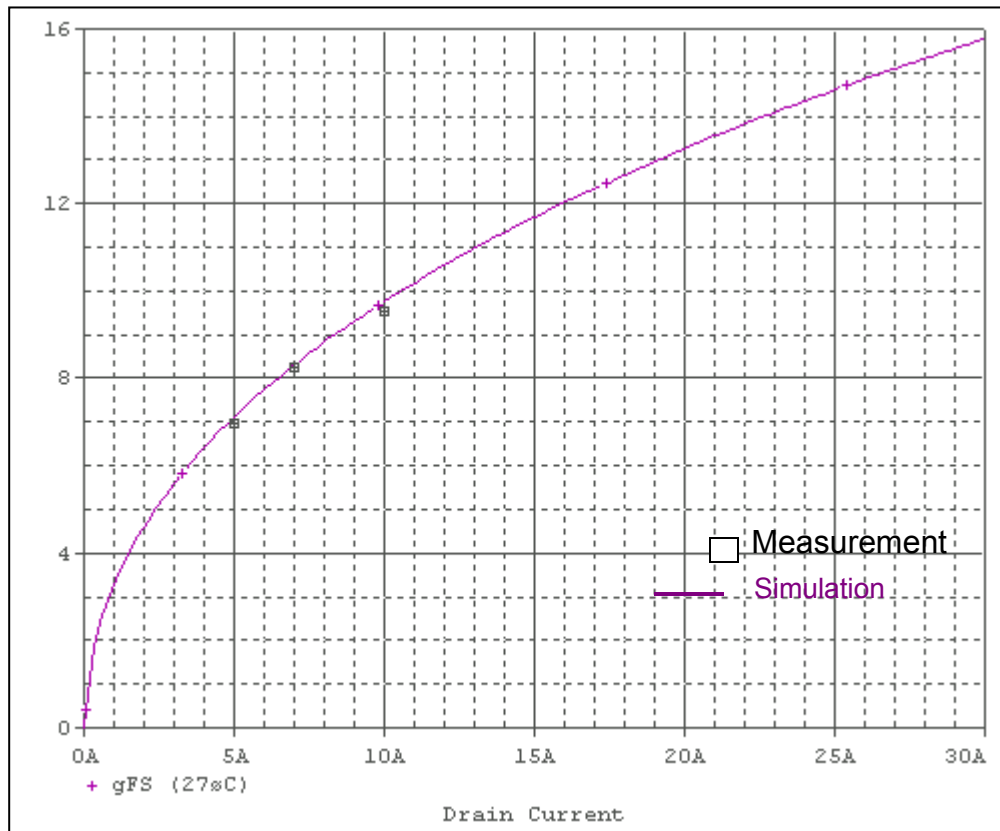
POWER MOSFET MODEL

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

Body Diode Model

Pspice model parameter	Model description
IS	Saturation Current
N	Emission Coefficient
RS	Series Resistance
IKF	High-injection Knee Current
CJO	Zero-bias Junction Capacitance
M	Junction Grading Coefficient
VJ	Junction Potential
ISR	Recombination Current Saturation Value
BV	Reverse Breakdown Voltage(a positive value)
IBV	Reverse Breakdown Current(a positive value)
TT	Transit Time

Transconductance Characteristic

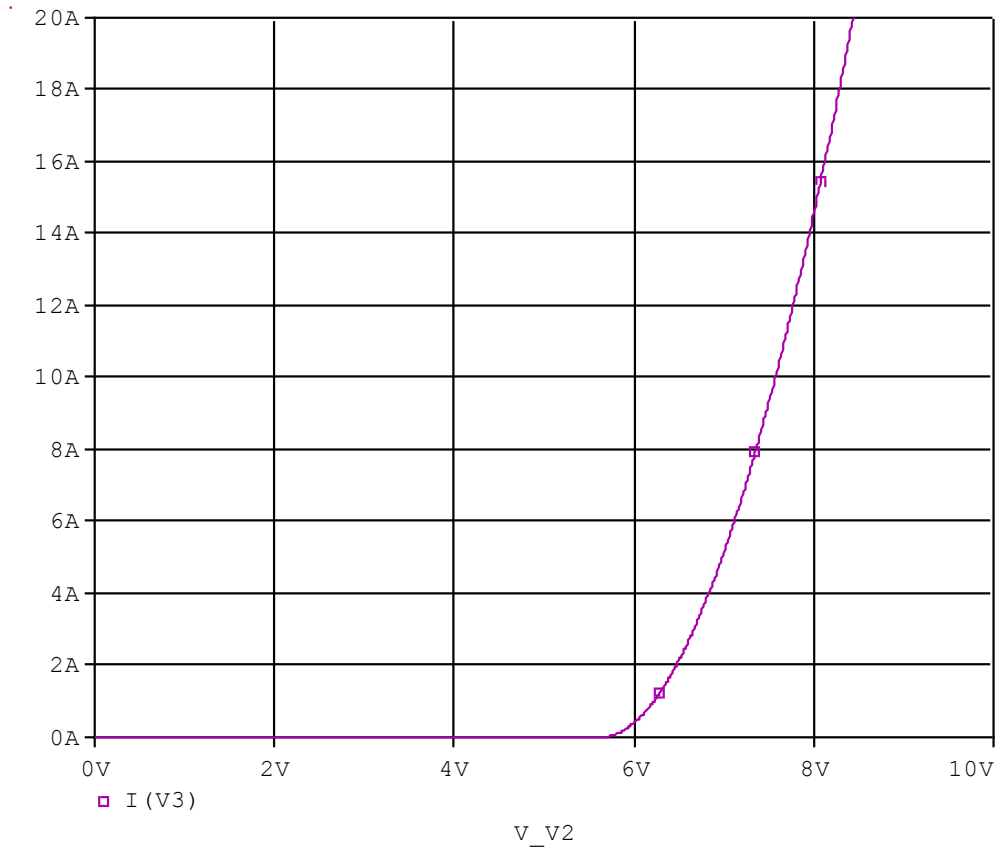


Simulation Result

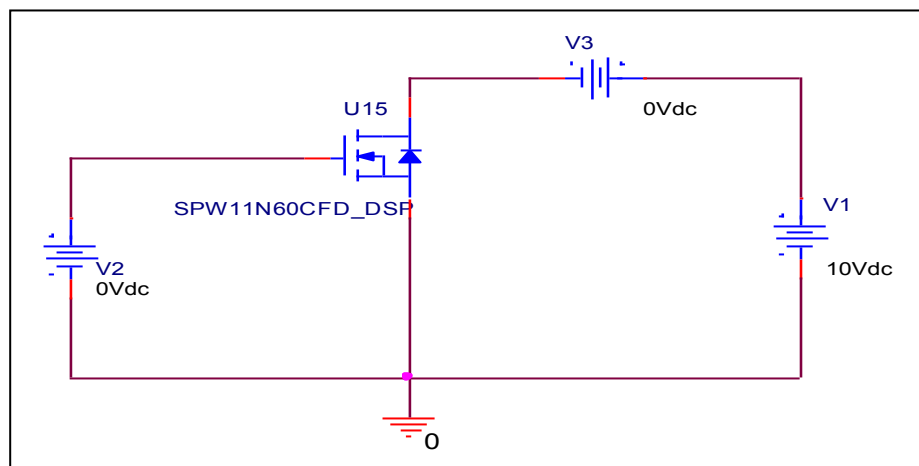
I_D (A)	g_{fs}		Error (%)
	Measurement	Simulation	
5.000	7.000	7.100	1.429
7.000	8.300	8.350	0.602
10.000	9.600	9.800	2.083

Vgs-Id Characteristic

Circuit Simulation result

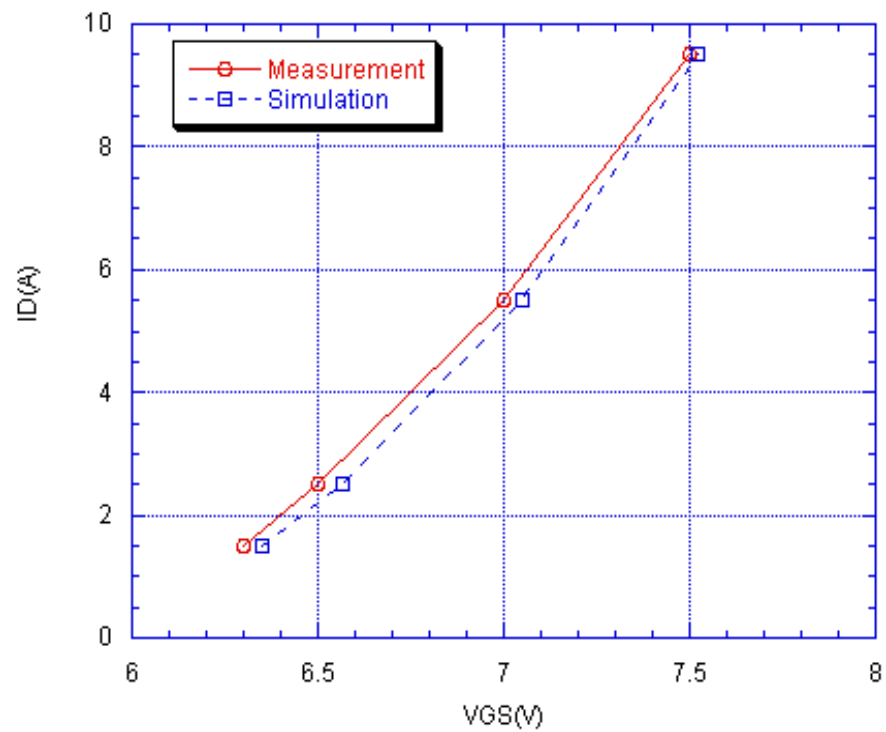


Evaluation circuit



Comparison Graph

Circuit Simulation Result

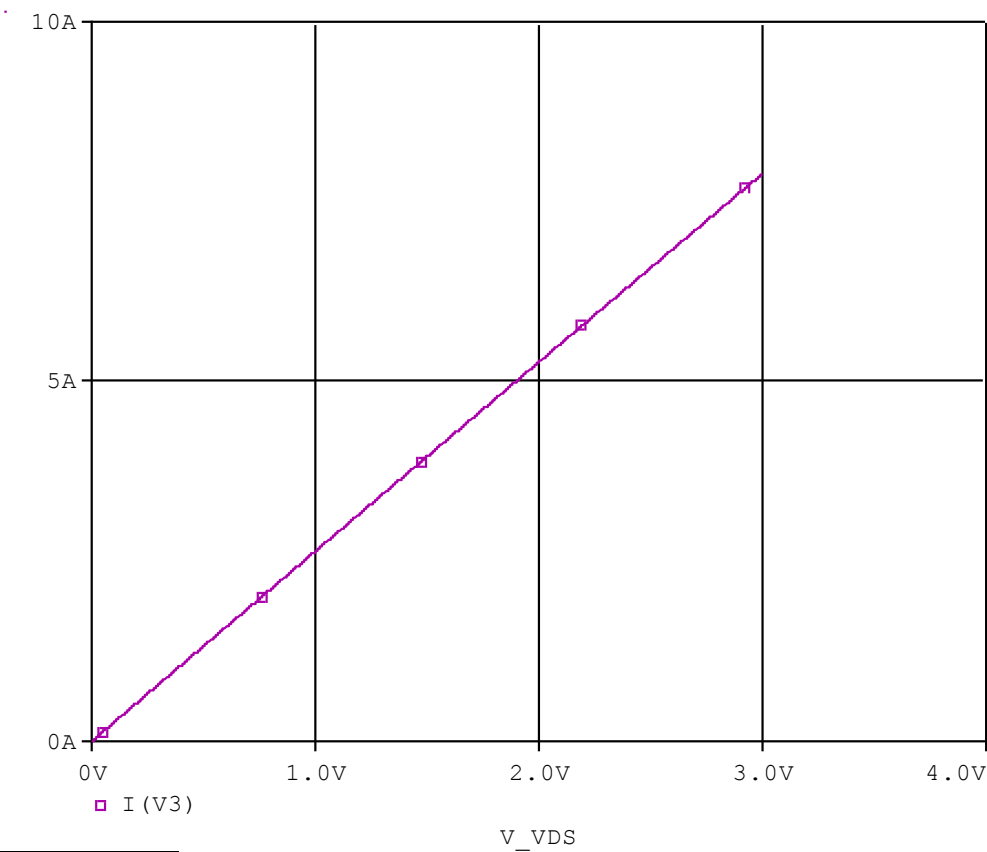


Simulation Result

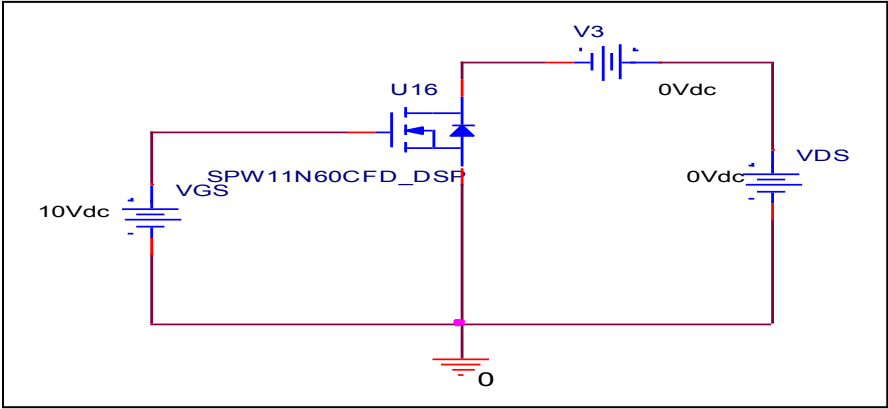
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
1.500	6.300	6.349	0.778
2.500	6.500	6.565	1.000
5.500	7.000	7.053	0.757
9.500	7.500	7.524	0.320

Id-Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

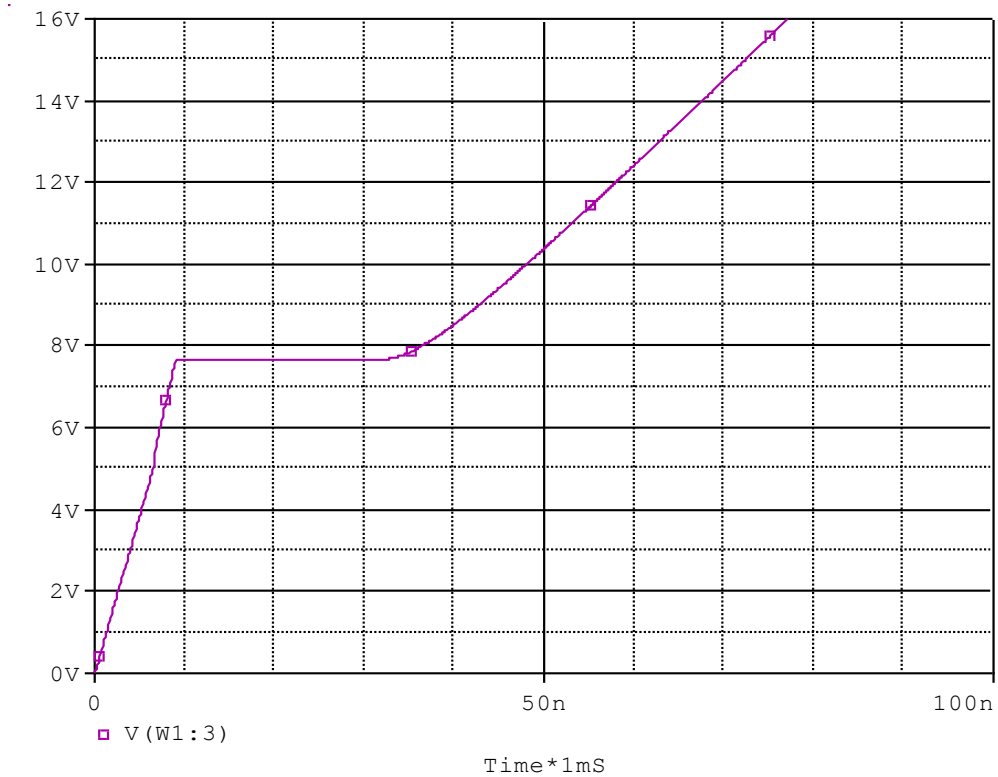


Simulation Result

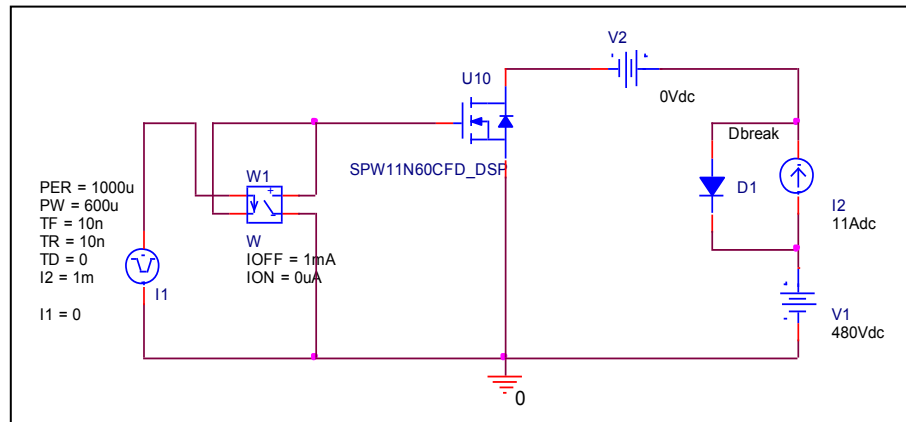
$I_D=20, V_{GS}=10V$	Measurement		Simulation		Error (%)
$R_{DS} \text{ (on)}$	380.000	mΩ	379.670	Ω	-0.086

Gate Charge Characteristic

Circuit Simulation result



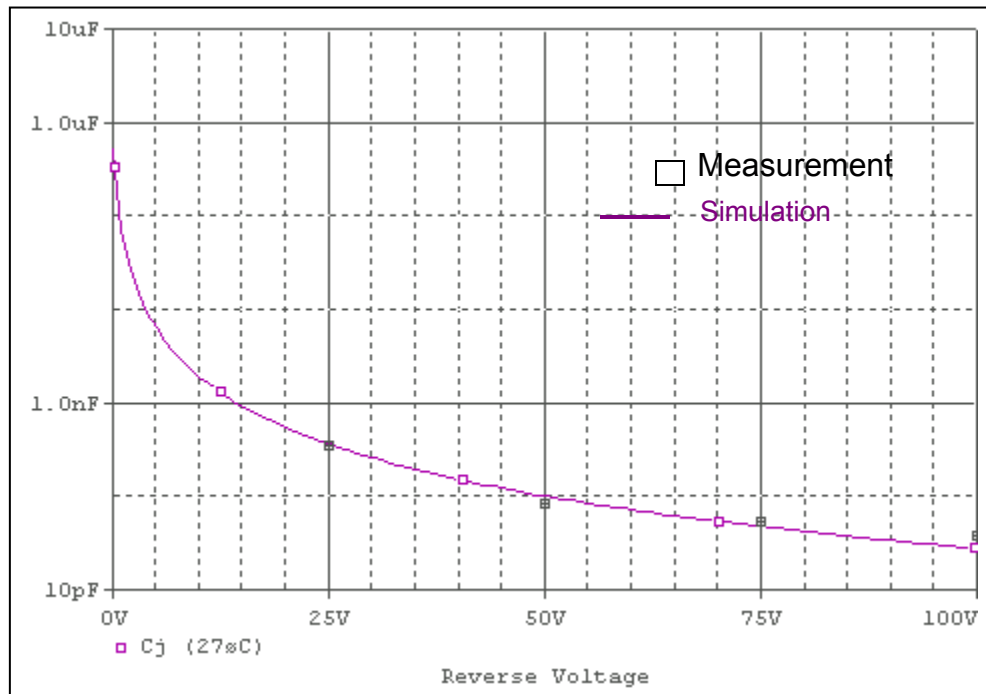
Evaluation circuit



Simulation Result

$V_{DD}=480V, I_D=11A$	Measurement		Simulation		Error (%)
Qgs	9.000	nC	9.031	nC	0.344
Qgd	23.000	nC	23.104	nC	0.452
Qg	48.000	nC	48.090	nC	0.188

Capacitance Characteristic

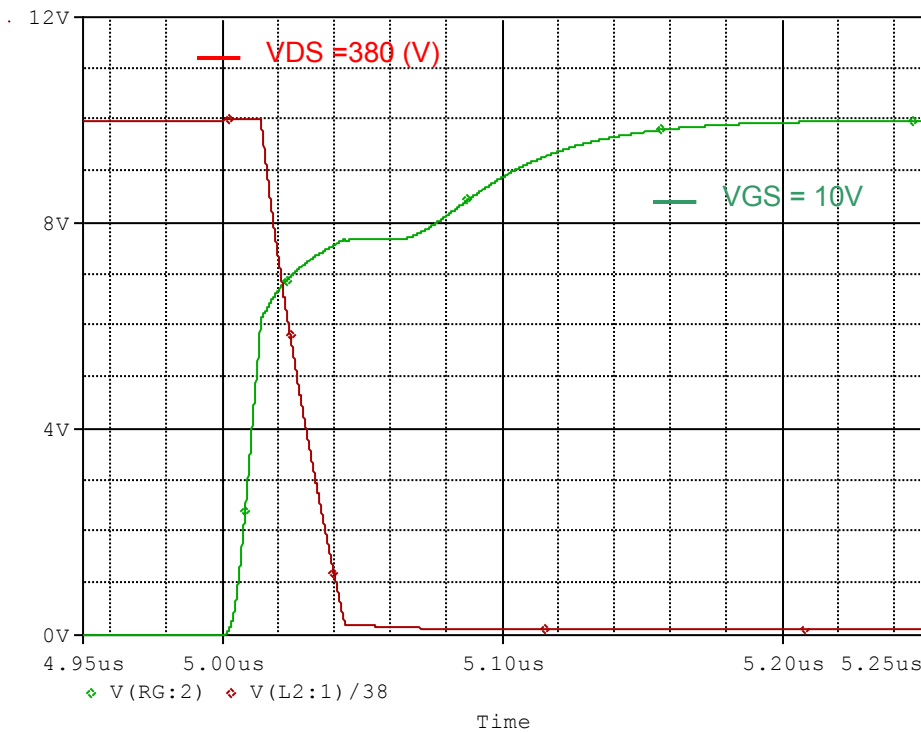


Simulation Result

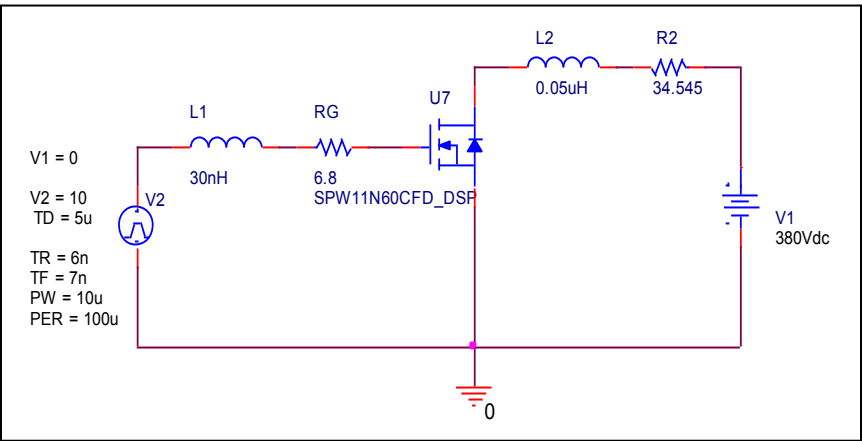
$V_{DS}(V)$	Cbd(pF)		Error(%)
	Measurement	Simulation	
25.000	363.00	371.000	2.204
50.000	87.800	90.425	2.990
75.000	55.000	54.100	-1.636
100.000	40.200	38.710	-3.706

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

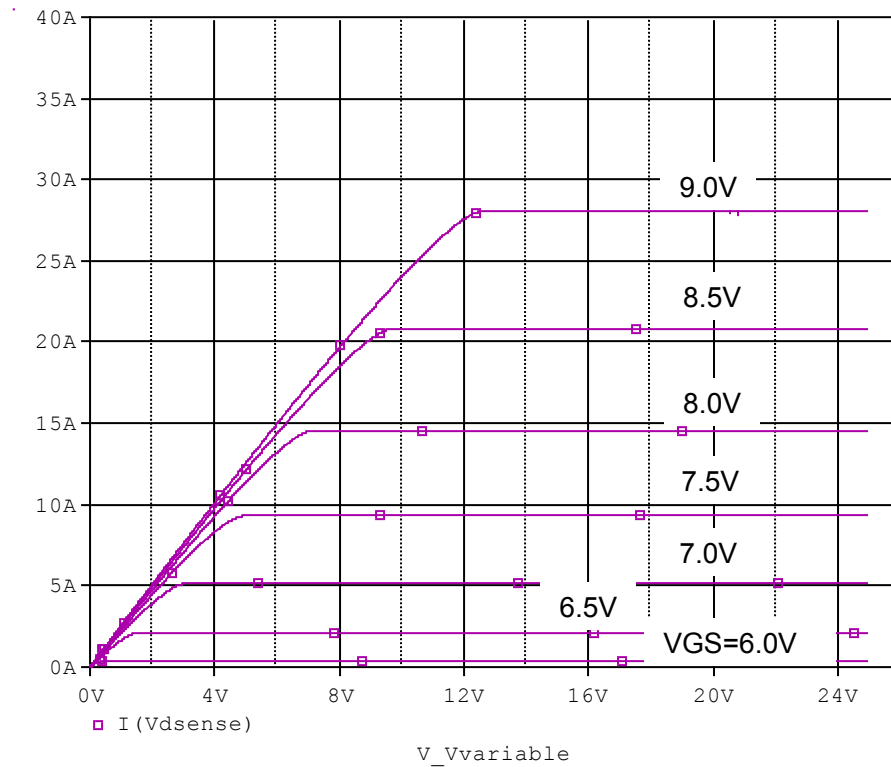


Simulation Result

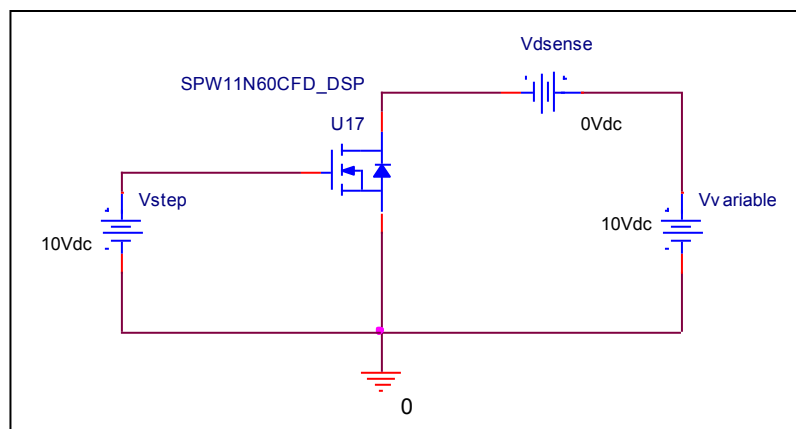
$I_D=11A, V_{DD}=380V$ $V_{GS}=0/10V$	Measurement		Simulation		Error(%)
td (on)	34.000	ns	34.913	ns	2.685

Output Characteristic

Circuit Simulation result

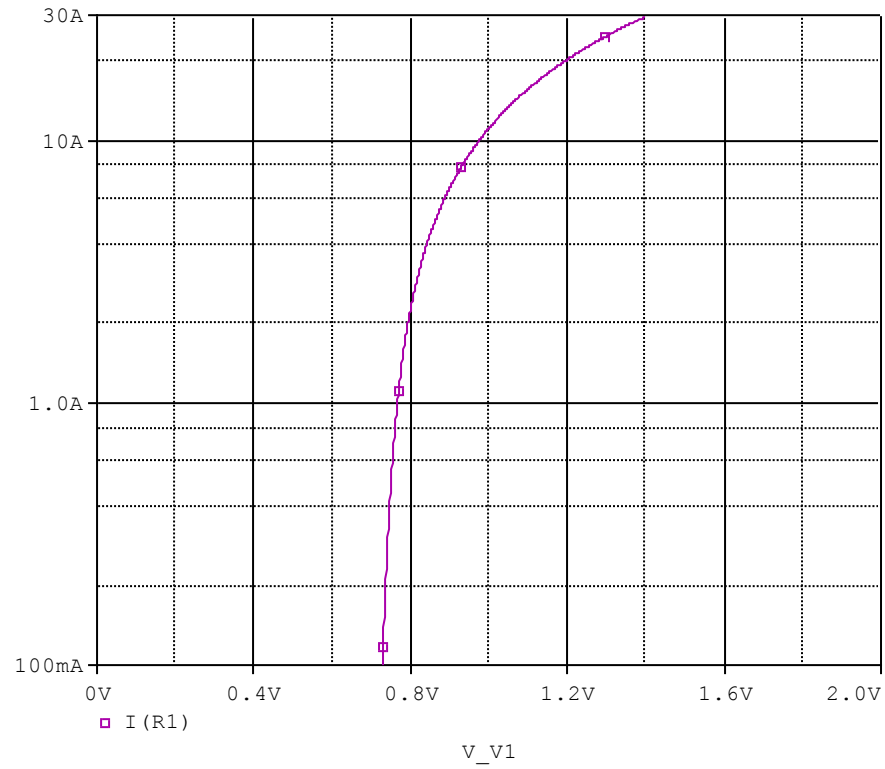


Evaluation circuit

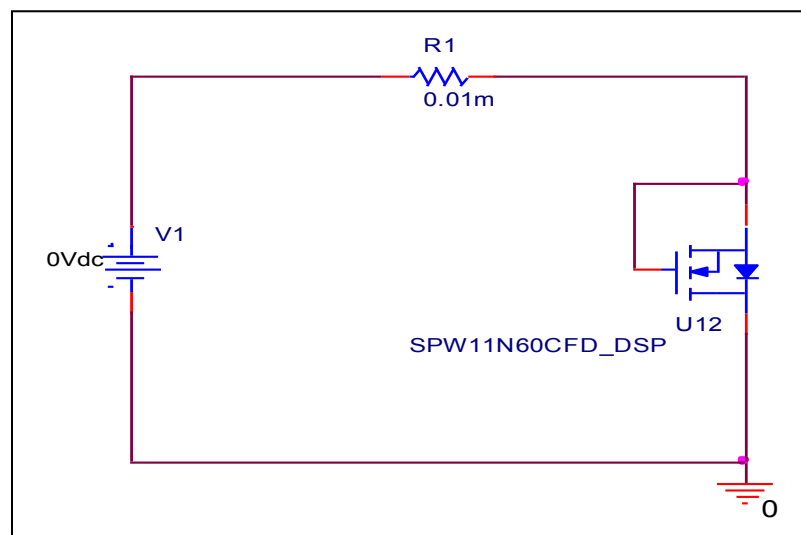


Forward Current Characteristic of Reverse Diode

Circuit Simulation Result

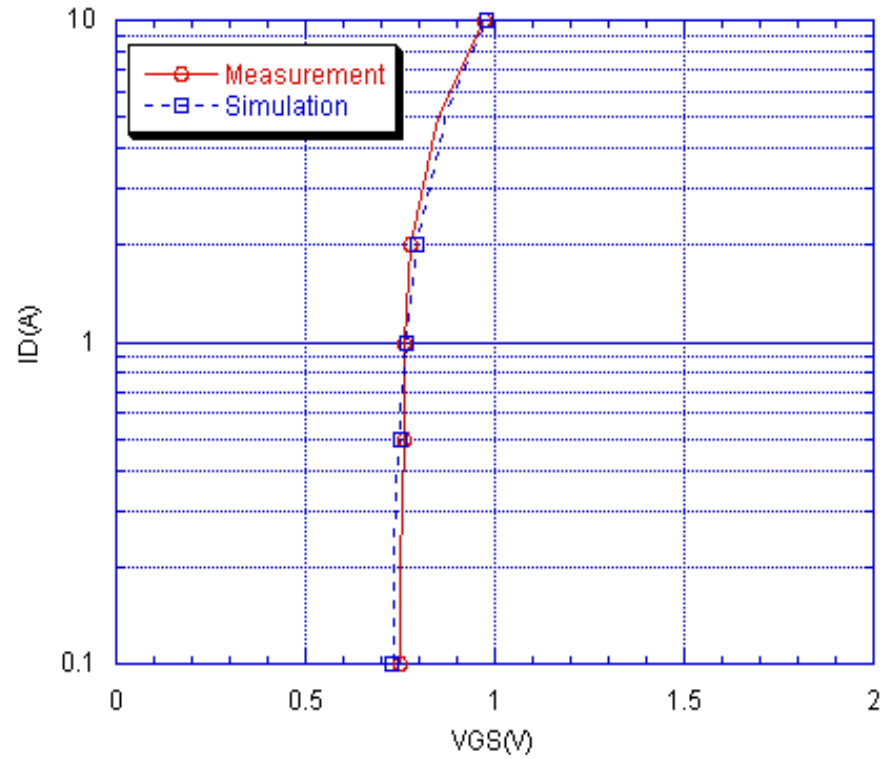


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

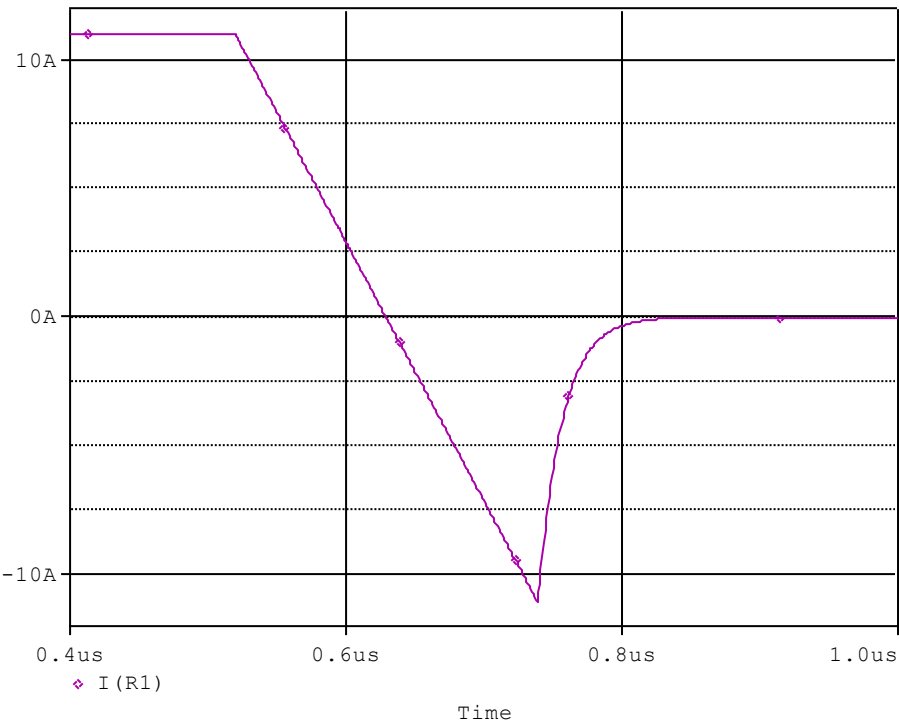


Simulation Result

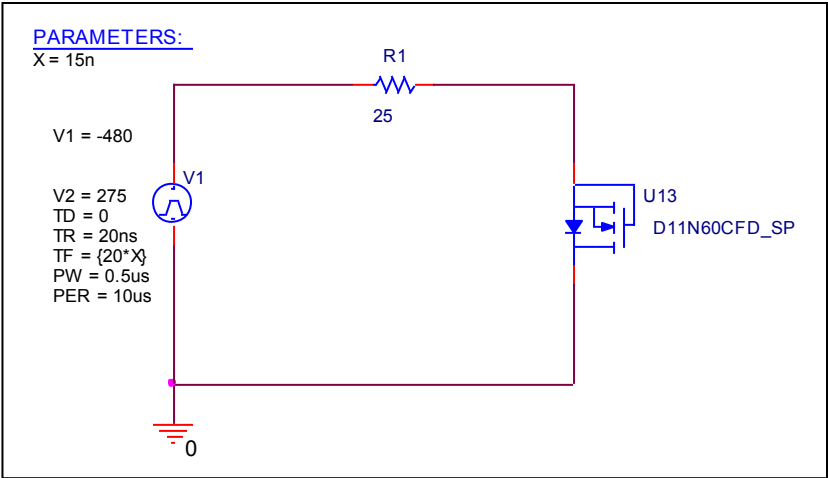
Ifwd(A)	Vfwd(V) Measurement	Vfwd(V) Simulation	%Error
0.100	0.750	0.728	-2.933
0.200	0.750	0.736	-1.867
0.500	0.760	0.749	-1.447
1.000	0.760	0.766	0.789
2.000	0.780	0.792	1.538
5.000	0.850	0.865	1.765
10.000	0.970	0.976	0.619

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit



Compare Measurement vs. Simulation

	Measurement		Simulation		Error(%)
trr	0.140	us	0.140	us	0