Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: SPA20N60CFD
MANUFACTURER: Infineon technologies
REMARK: Body Diode (Special)

Bee Technologies Inc.

All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

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

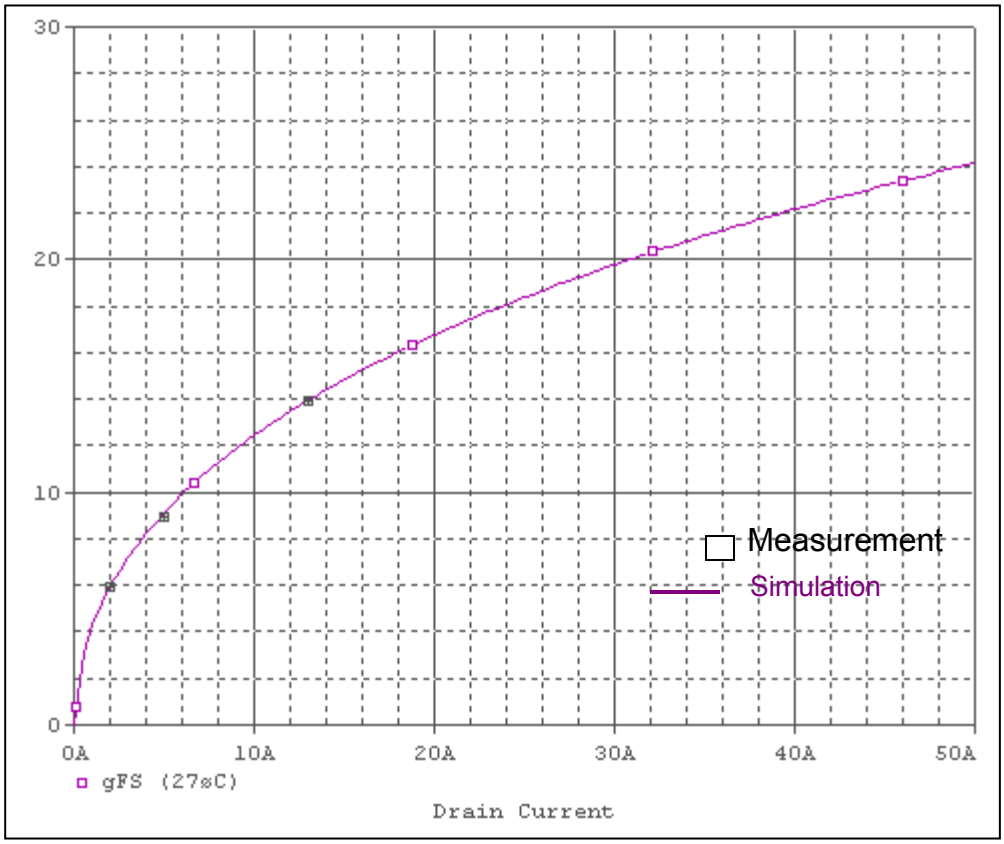
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

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

All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Transconductance Characteristic



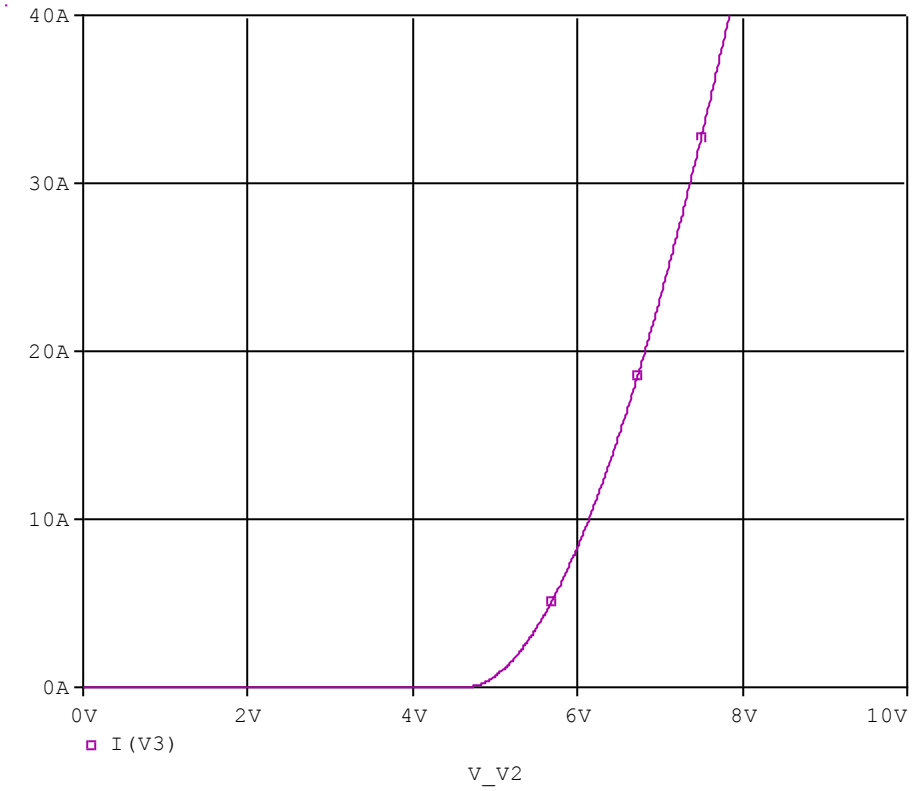
Simulation Result

I_D(A)	g_{fs}		Error (%)
	Measurement	Simulation	
2.000	6.000	6.000	0.000
5.000	9.000	9.023	0.256
13.000	14.000	14.011	0.079

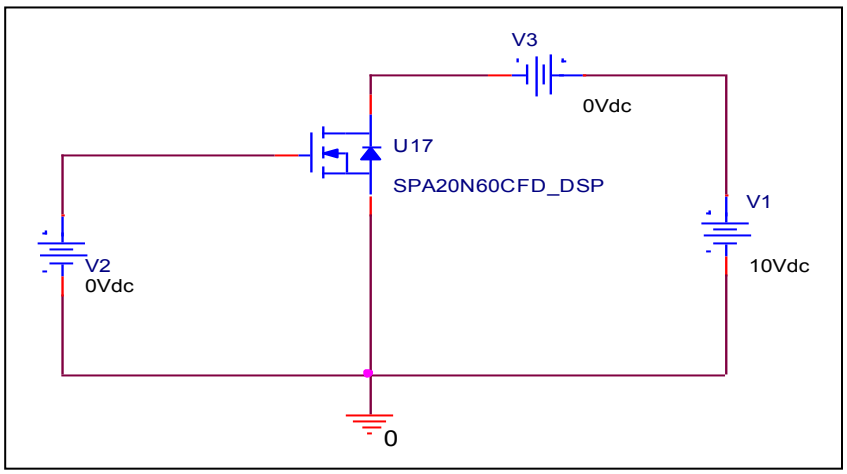
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Vgs-Id Characteristic

Circuit Simulation result



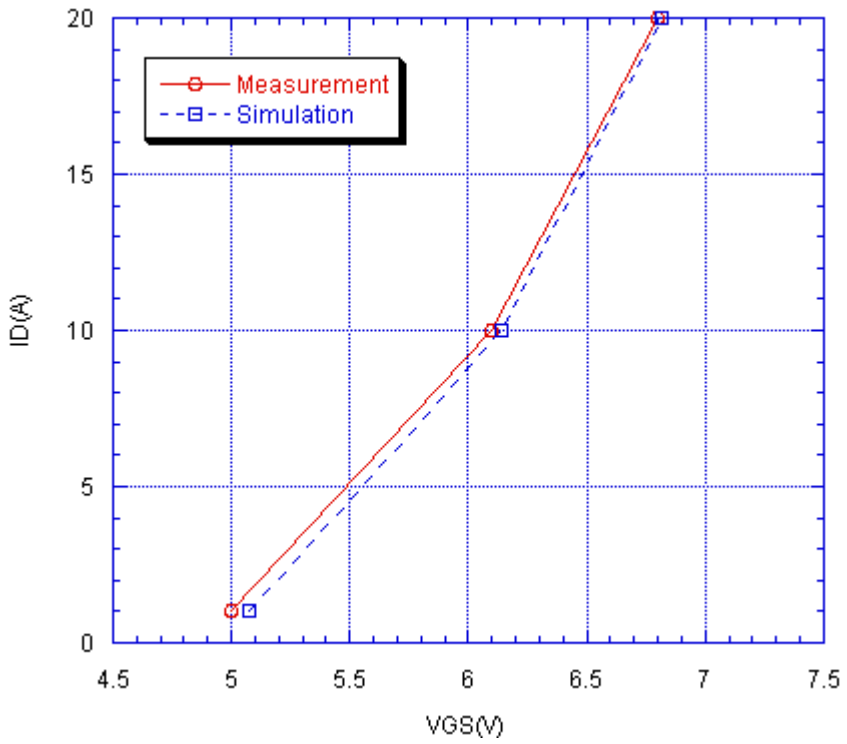
Evaluation circuit



All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Comparison Graph

Circuit Simulation Result



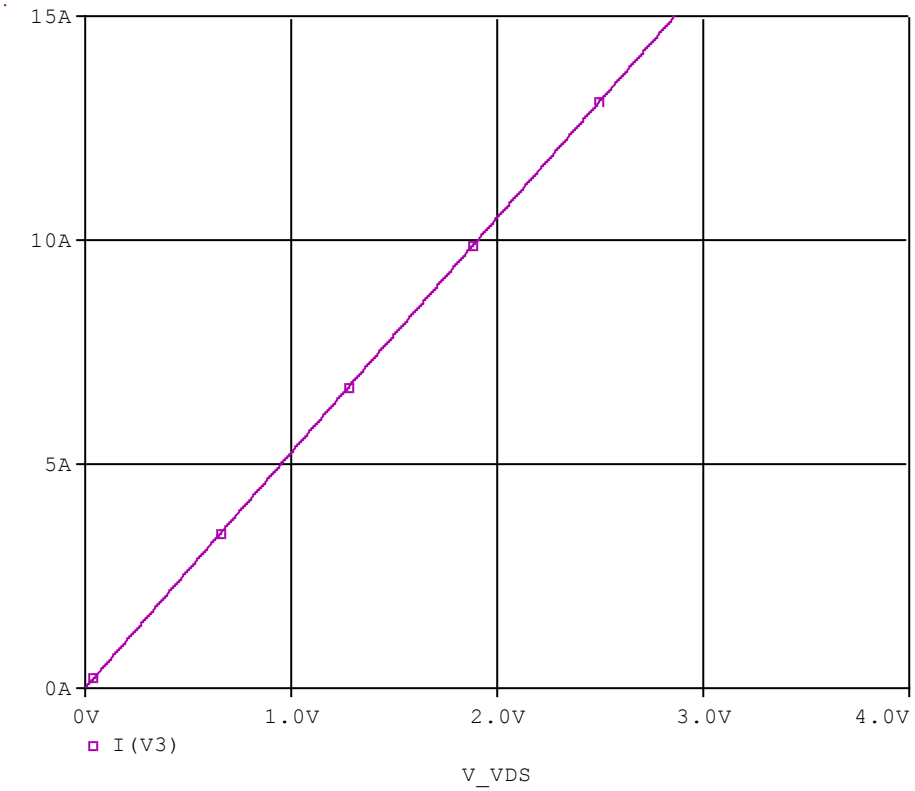
Simulation Result

I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
1.000	5.000	5.078	1.560
10.000	6.100	6.136	0.590
20.000	6.800	6.818	0.265

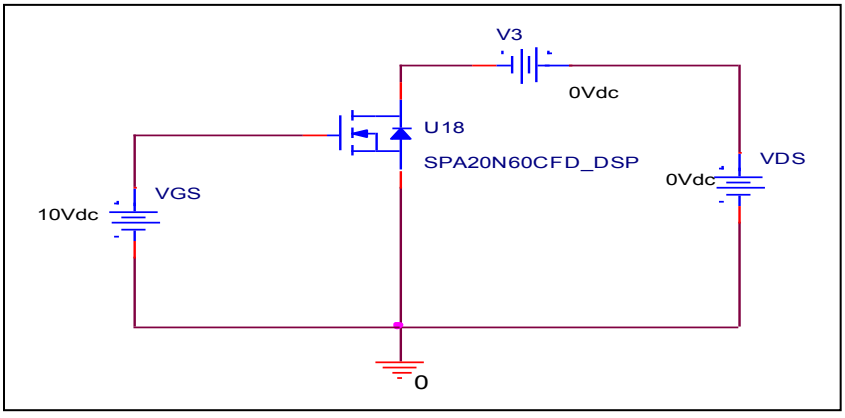
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Id-Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit



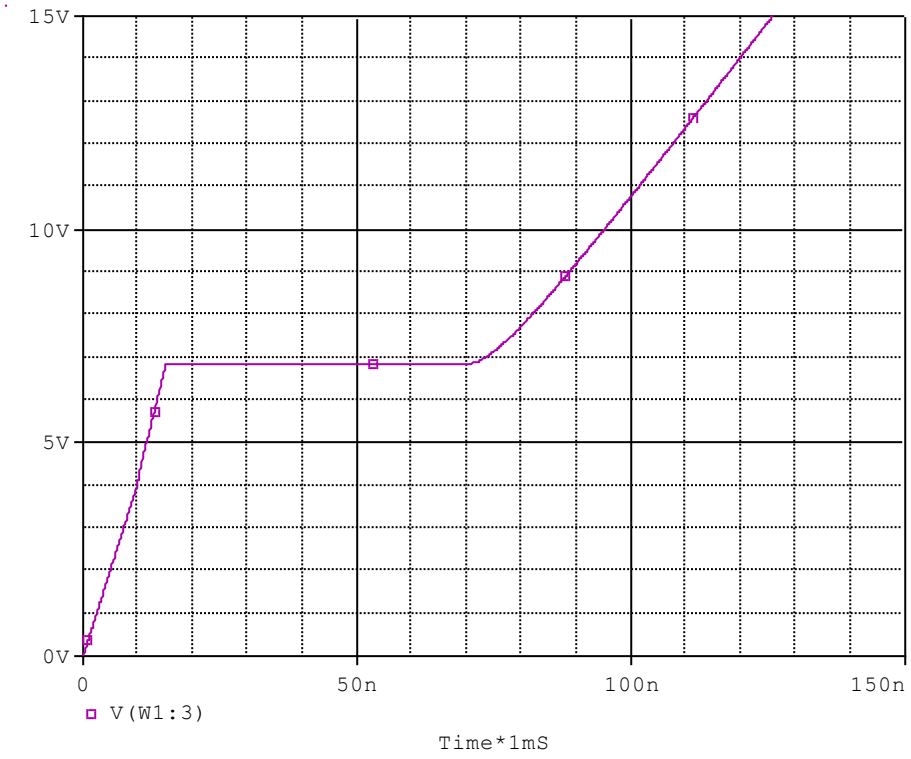
Simulation Result

I_D=13.1, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	190.000	mΩ	190.000	Ω	0.000

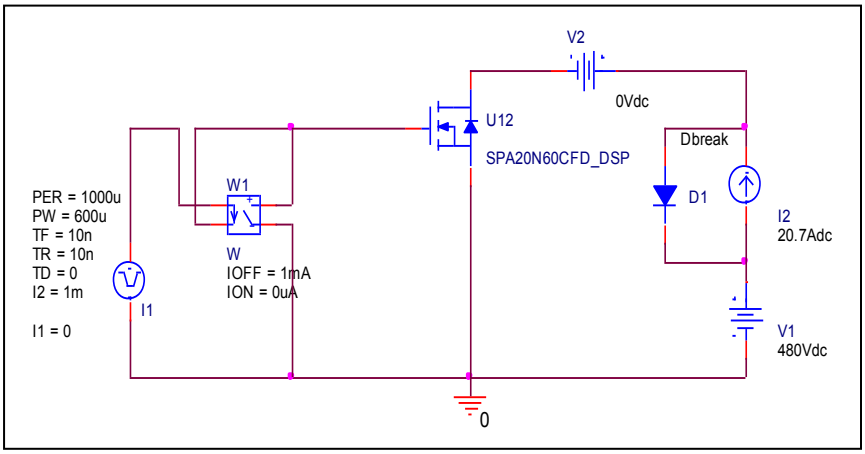
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit

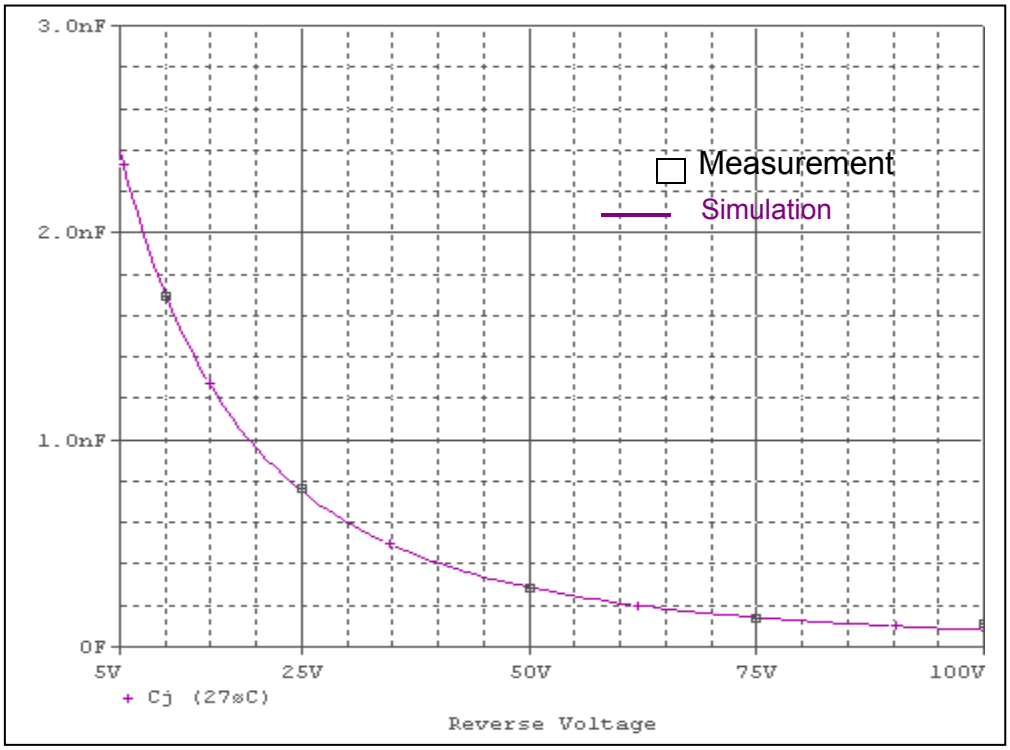


Simulation Result

V_{DD}=480V,I_D=20.7A	Measurement		Simulation		Error (%)
Qgs	15.000	nC	15.052	nC	0.347
Qgd	54.000	nC	54.292	nC	0.541
Qg	95.000	nC	95.000	nC	0.000

All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Capacitance Characteristic



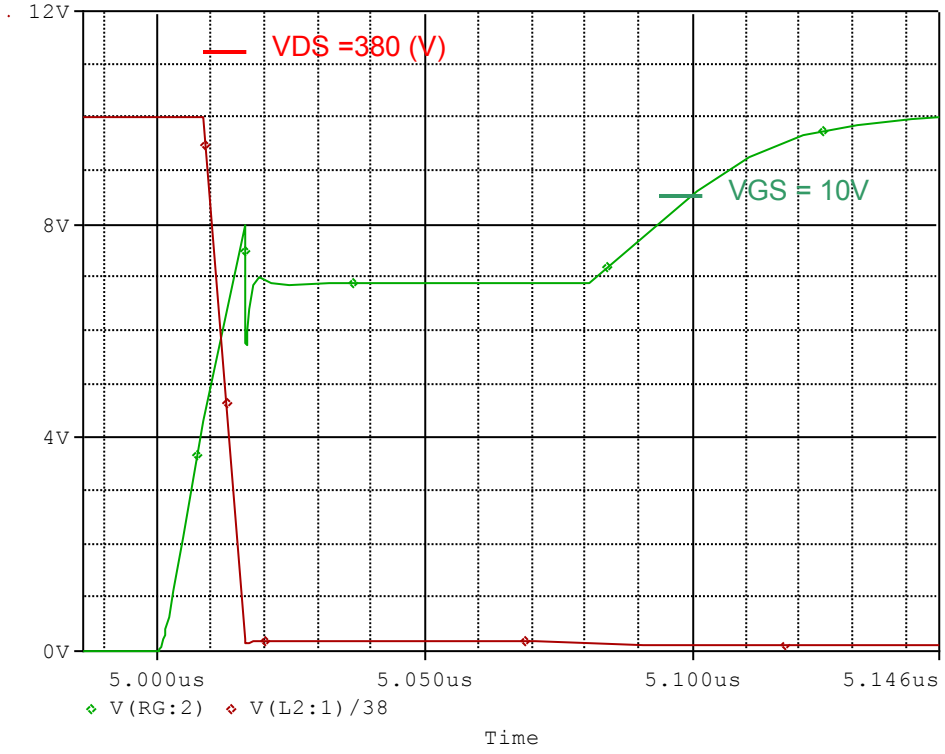
Simulation Result

V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
10.000	1700.000	1710.000	0.588
25.000	770.000	757.000	-1.688
50.000	290.000	293.000	1.034
75.000	150.000	152.000	1.333
100.000	120.000	115.000	-4.167

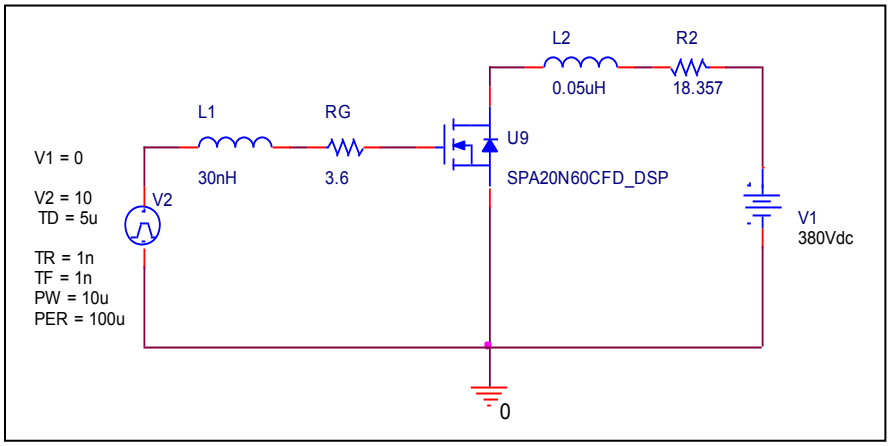
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit



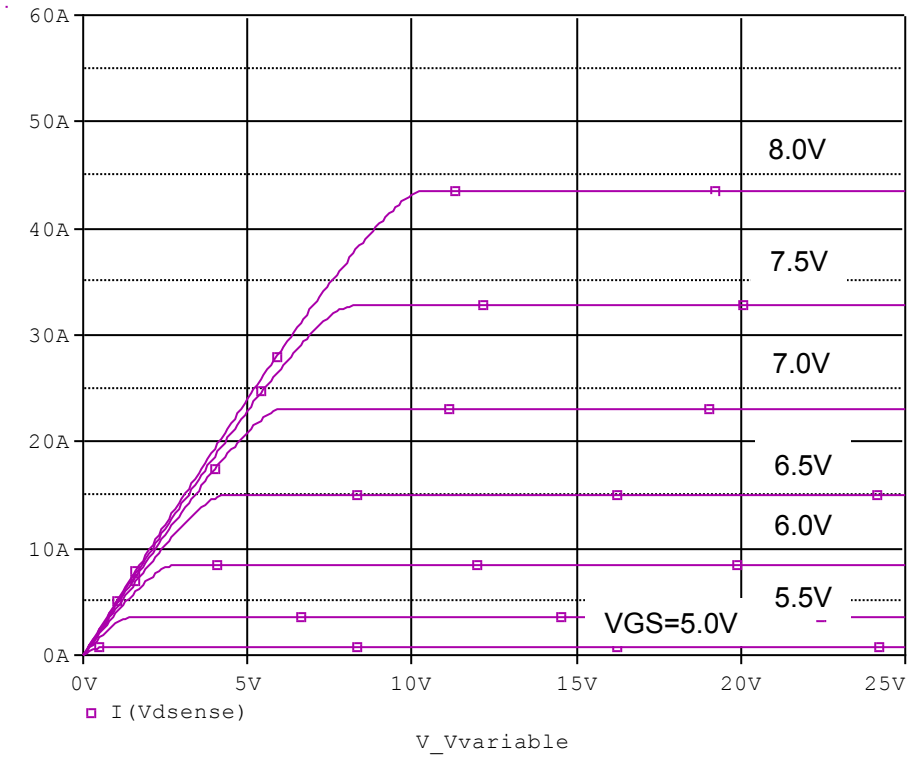
Simulation Result

I_D=20.7A, V_{DD}=380V V_{GS}=0/10V	Measurement		Simulation		Error(%)
td (on)	12.000	ns	12.517	ns	4.308

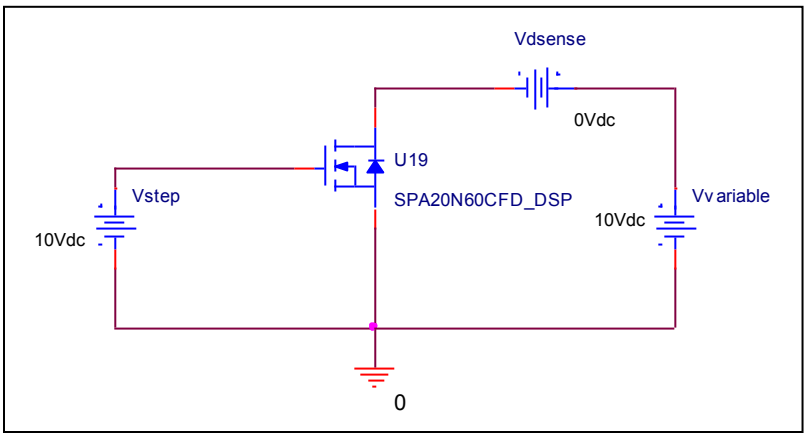
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Output Characteristic

Circuit Simulation result



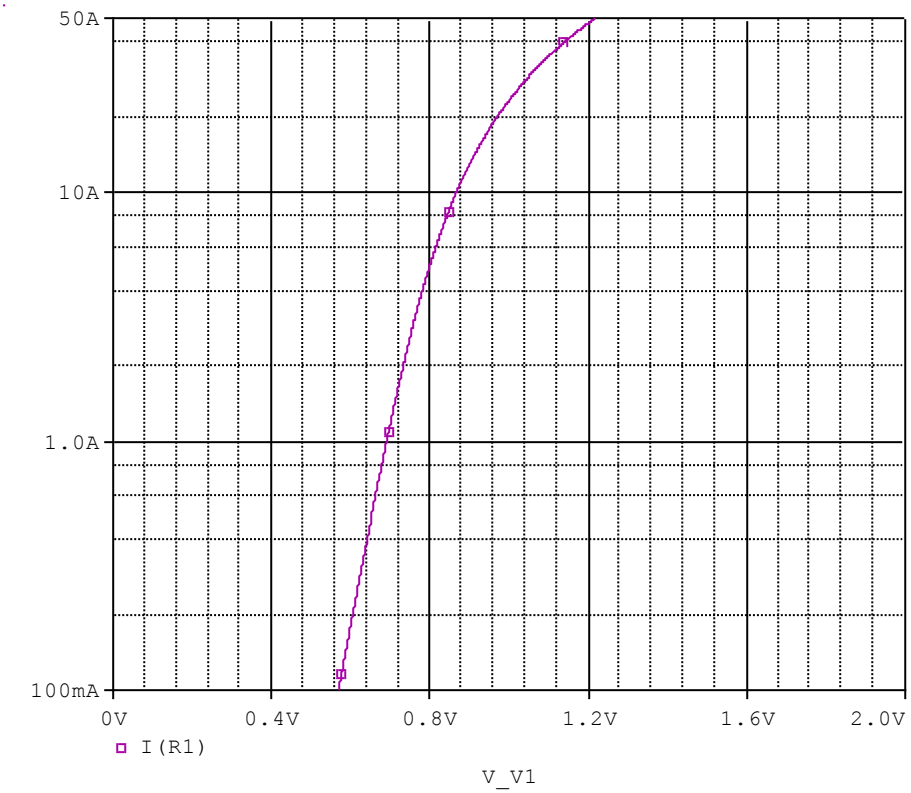
Evaluation circuit



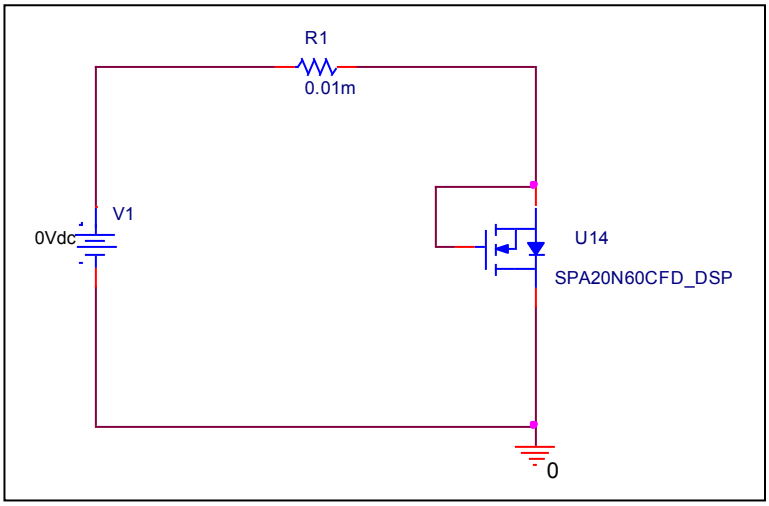
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Forward Current Characteristic of Reverse Diode

Circuit Simulation Result



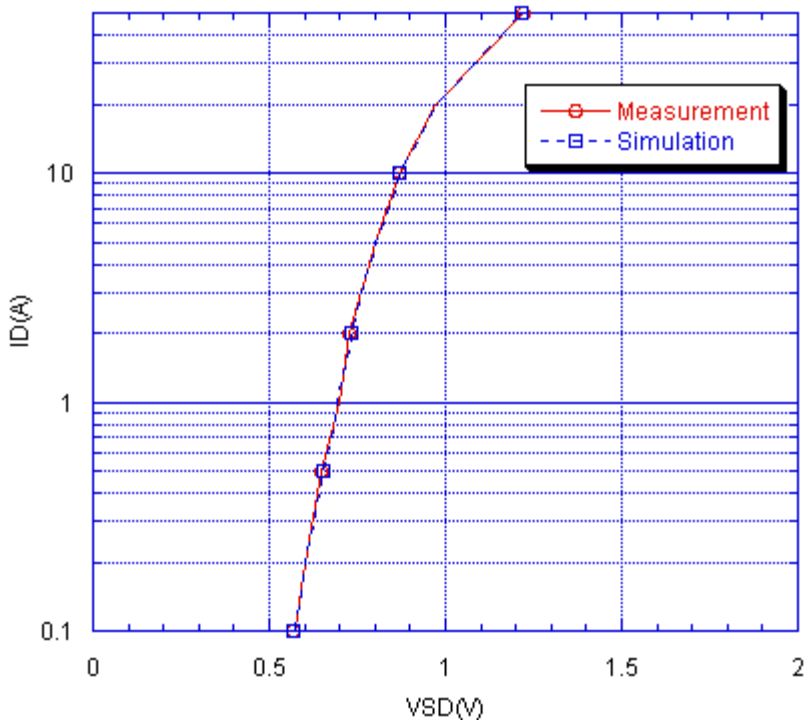
Evaluation Circuit



All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Comparison Graph

Circuit Simulation Result



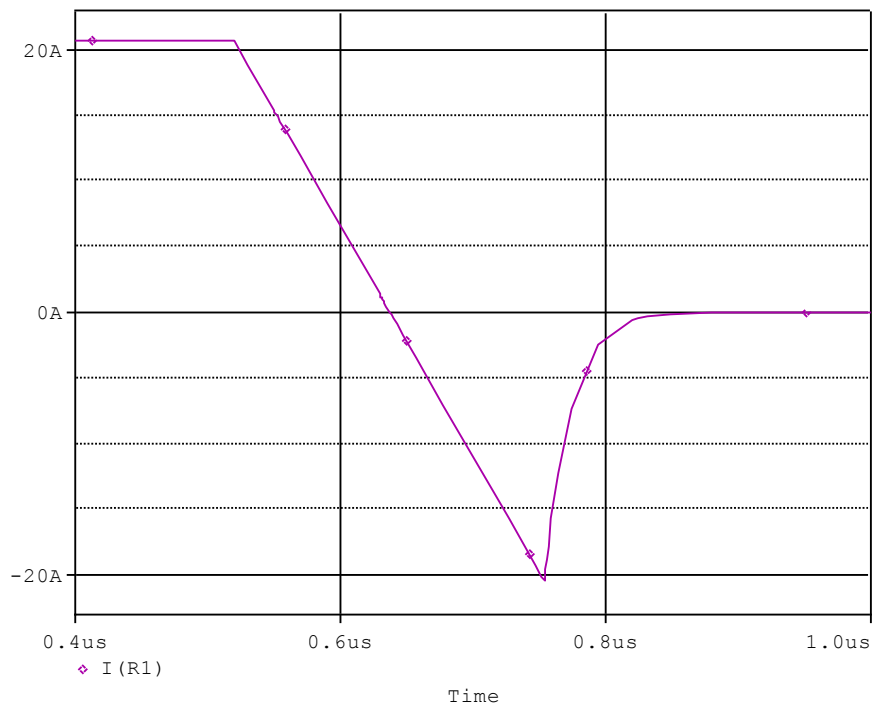
Simulation Result

Ifwd(A)	Vfwd(V) Measurement	Vfwd(V) Simulation	%Error
0.100	0.570	0.569	-0.175
0.200	0.600	0.604	0.667
0.500	0.650	0.652	0.308
1.000	0.700	0.691	-1.286
2.000	0.730	0.731	0.137
5.000	0.800	0.800	0.000
10.000	0.870	0.867	-0.345
20.000	0.970	0.970	0.000
50.000	1.220	1.218	-0.164

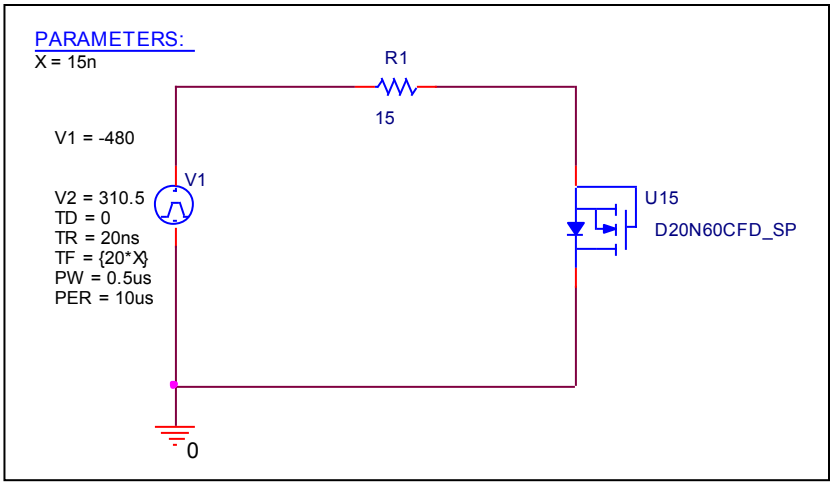
All Rights Reserved Copyright (c) Bee Technologies Inc. 2005

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit



Compare Measurement vs. Simulation

	Measurement		Simulation		Error(%)
trr	**0.150**	**us**	**0.150**	**us**	**0**

All Rights Reserved Copyright (c) Bee Technologies Inc. 2005