Device Modeling Report

COMPONENTS: MOSFET (Professional)
PART NUMBER: SSM3K15FS
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

Bee Technologies Inc.

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MOSFET MODEL PARAMETERS

PSpice model parameters	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

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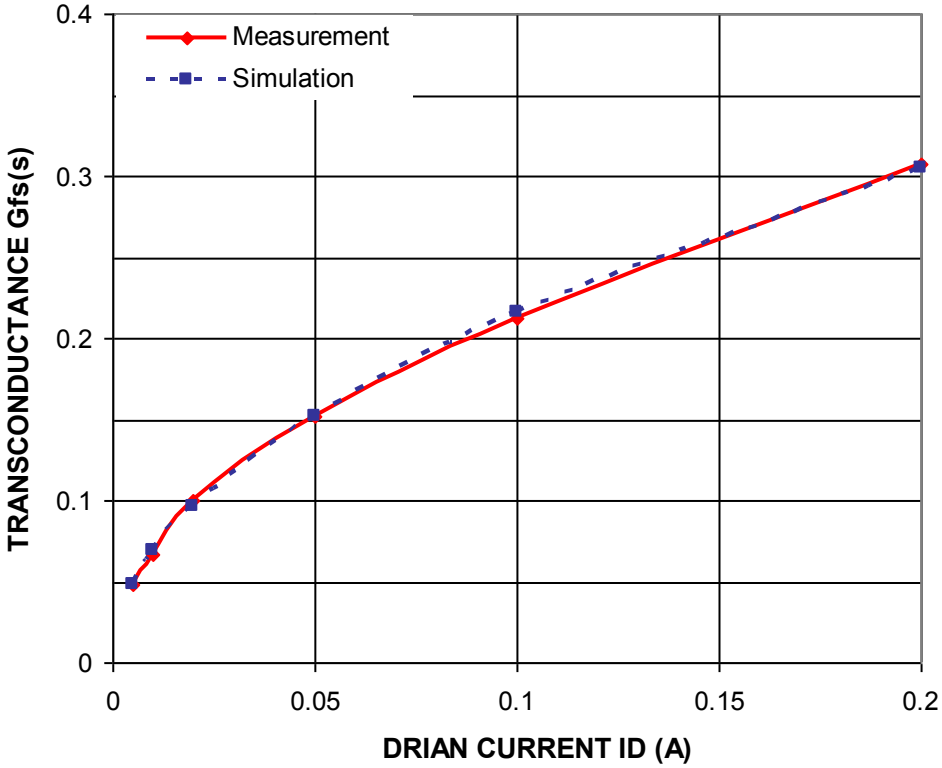
Transconductance Characteristic

Circuit Simulation Result



Comparison table

Id(A)	Gfs(S)		Error(%)
	Measurement	Simulation	
0.005	0.0476	0.0481	0.96
0.01	0.0667	0.0690	3.45
0.02	0.1000	0.0966	-3.38
0.05	0.1515	0.1524	0.61
0.1	0.2128	0.2155	1.29
0.2	0.3077	0.3044	-1.07

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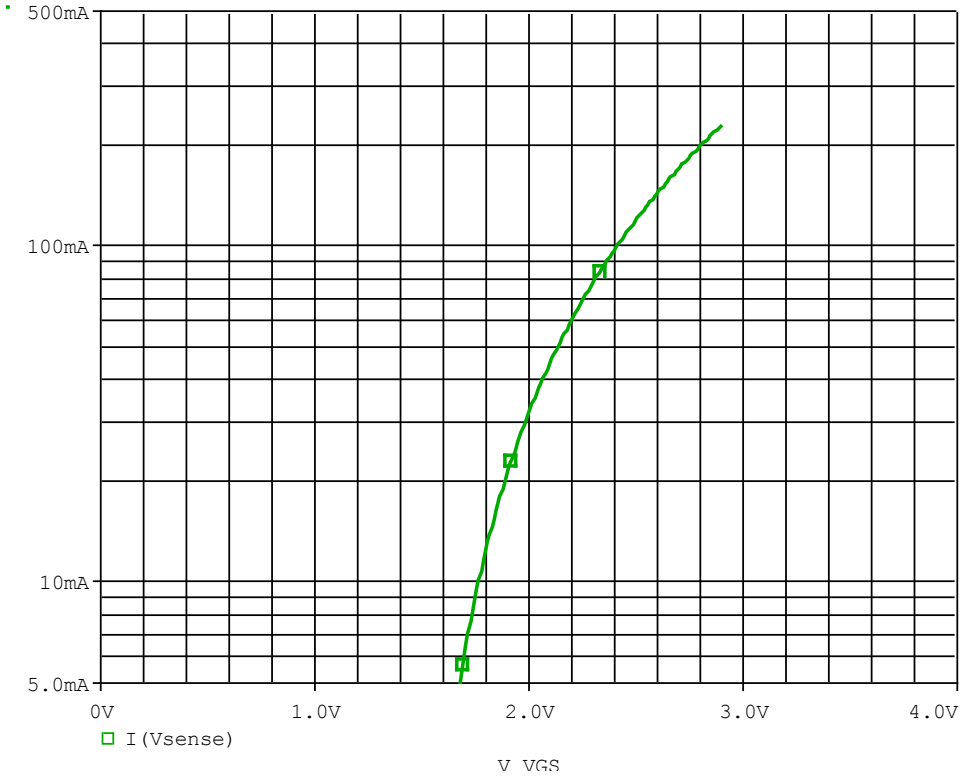
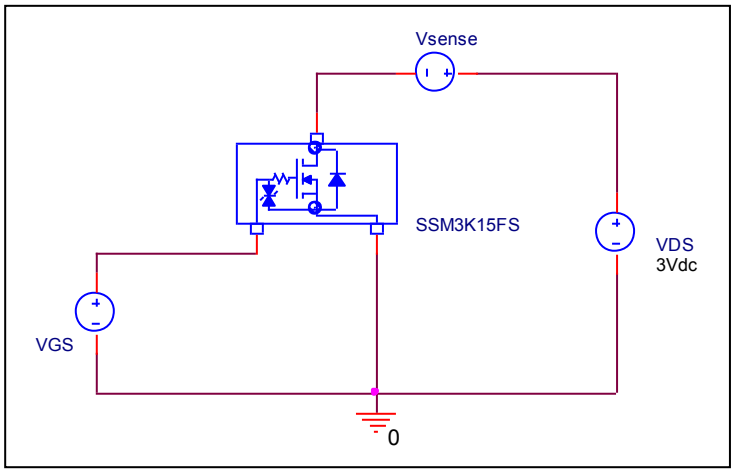
Vgs-Id Characteristic

Circuit Simulation result



Evaluation circuit



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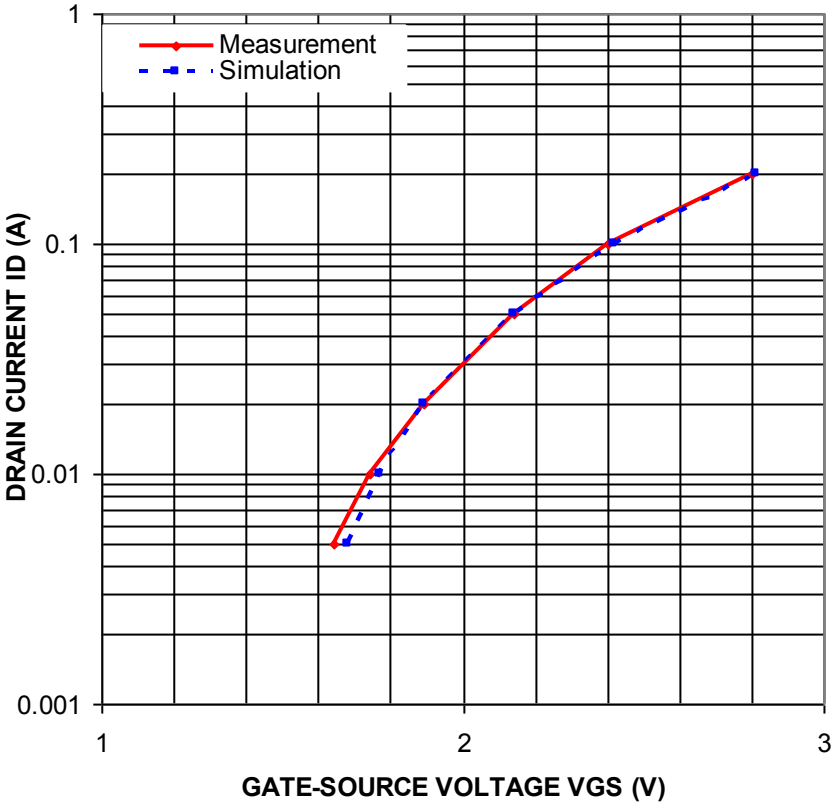
Comparison Graph

Circuit Simulation Result



Simulation Result

I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.005	1.6400	1.6808	2.4878
0.01	1.7400	1.7689	1.6609
0.02	1.8900	1.8931	0.1640
0.05	2.1400	2.1400	0.0000
0.1	2.4000	2.4184	0.7667
0.2	2.8000	2.8124	0.4429

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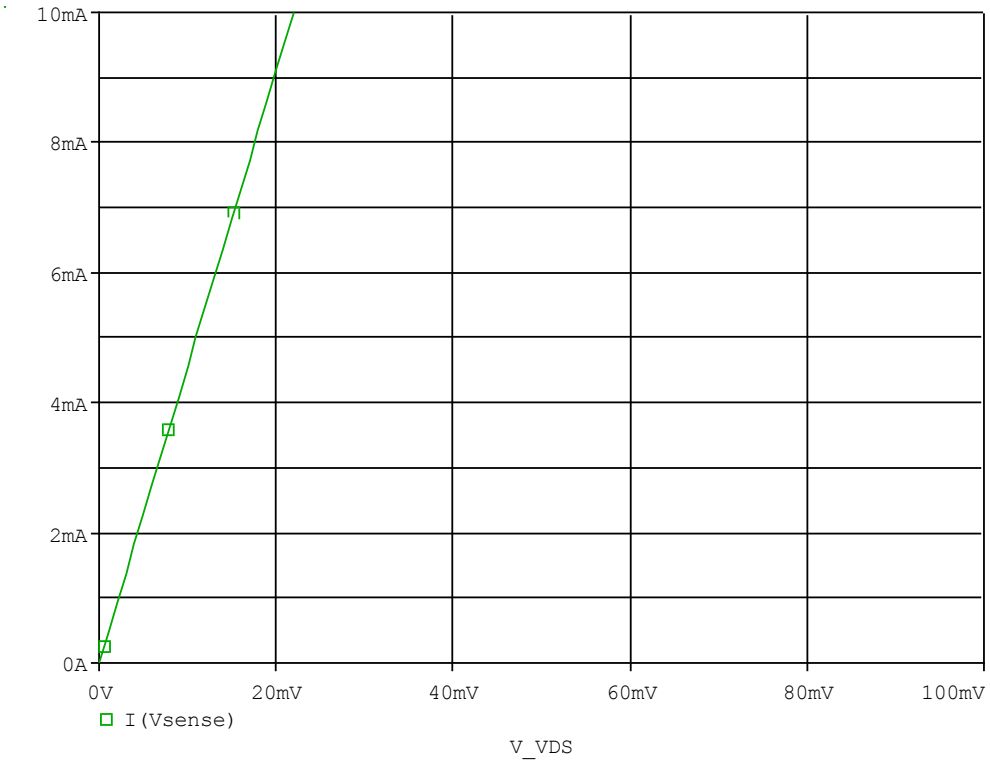
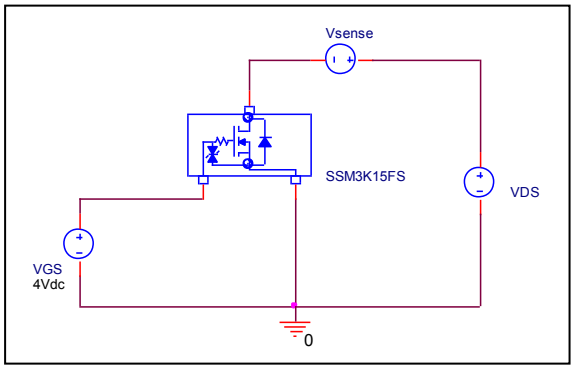
Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=10mA, V_{GS}=4V	Measurement		Simulation		Error (%)
R_{DS} (on)	2.2	Ω	2.1997	Ω	-0.01

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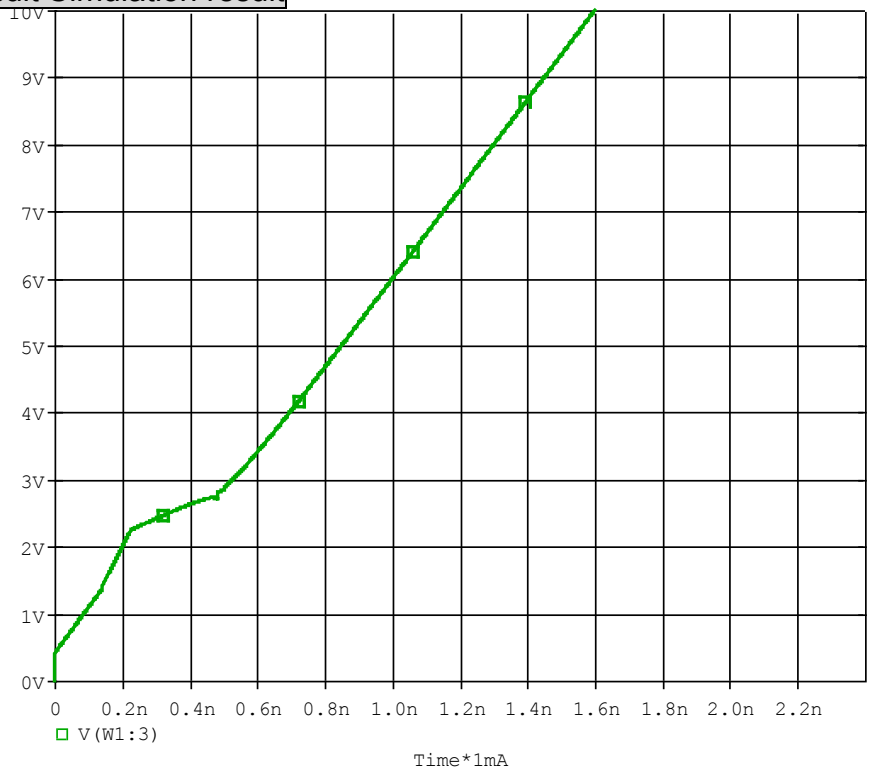
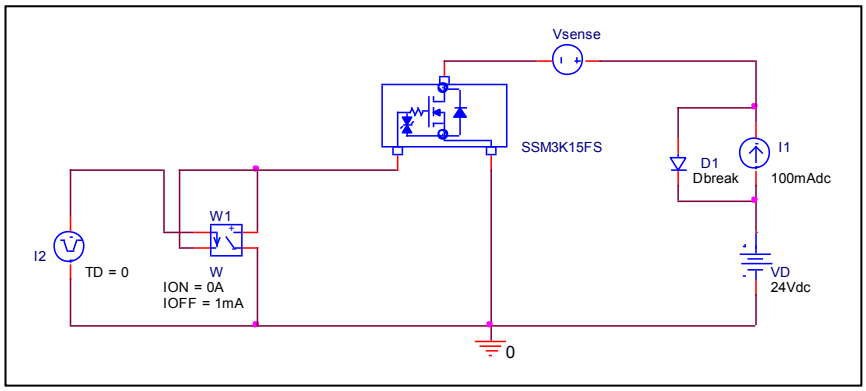
Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

V_{DD}=24V, I_D=100mA	Measurement		Simulation		Error (%)
Qgs	0.2250	nC	0.2305	nC	2.4640
Qgd	0.2400	nC	0.24045	nC	0.1875
Qg	1.6000	nC	1.6000	nC	0.0000

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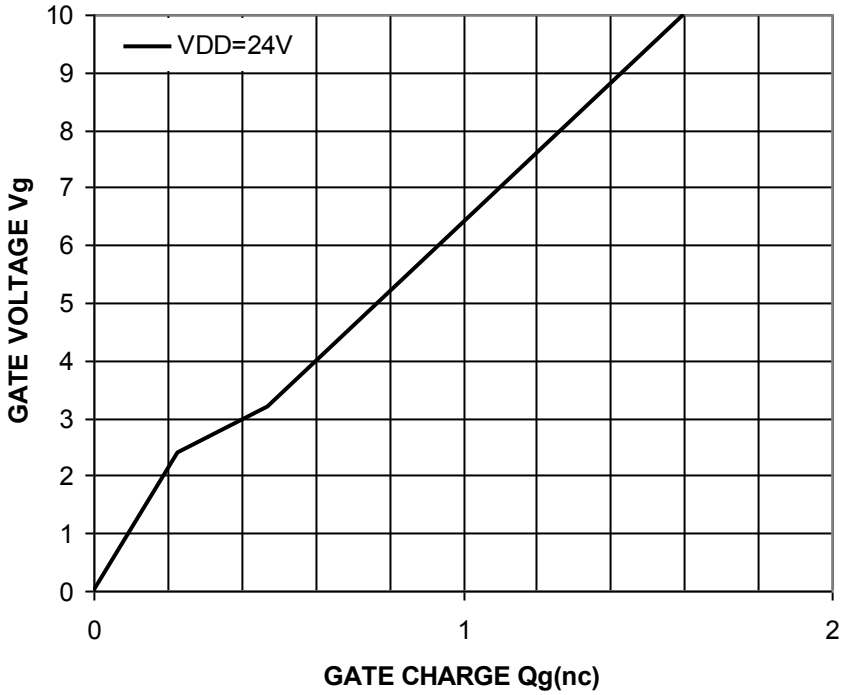
Gate Charge Characteristic Reference



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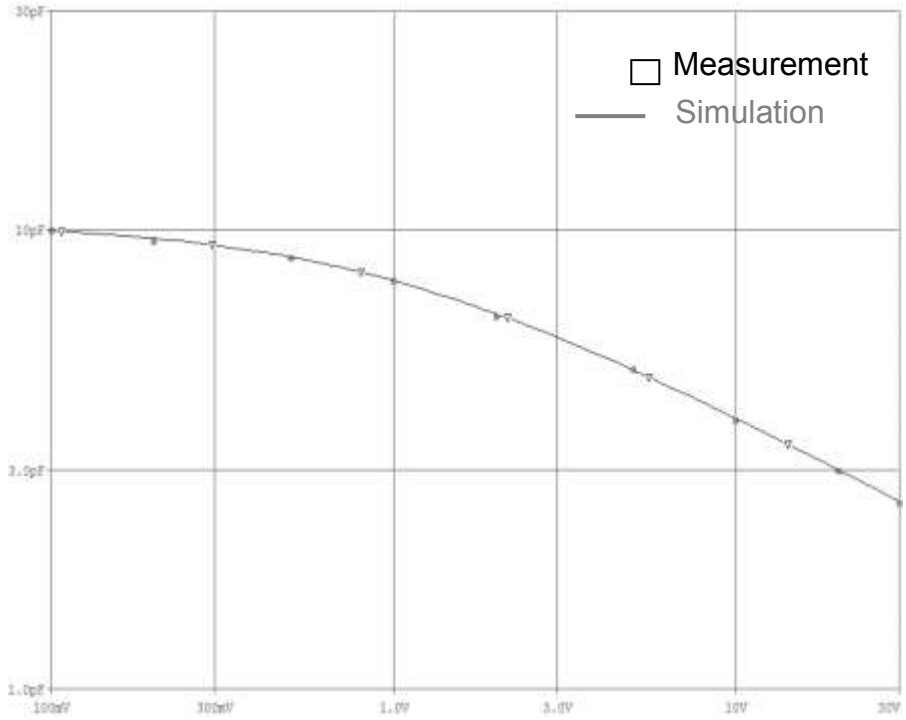
Capacitance Characteristic



Simulation Result

V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	10.0000	9.9373	-0.6270
0.2	9.5000	9.5740	0.7789
0.5	8.7000	8.7257	0.2954
1	7.8000	7.7356	-0.8256
2	6.5000	6.5580	0.8923
5	5.0000	4.9462	-1.0760
10	3.8500	3.8749	0.6468
20	3.0000	2.9900	-0.3333

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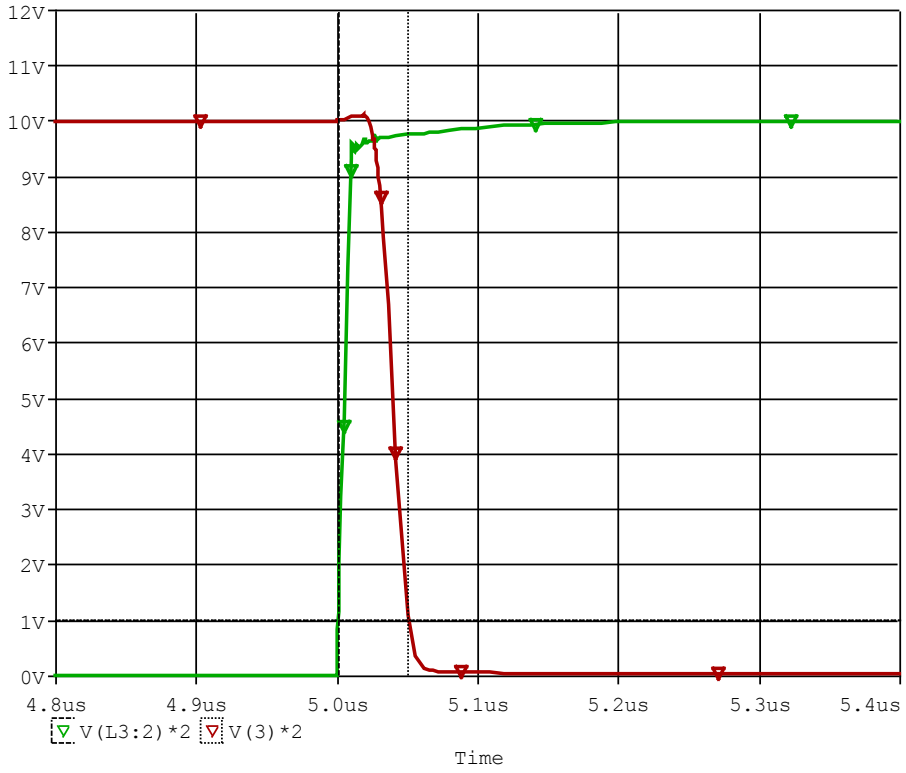
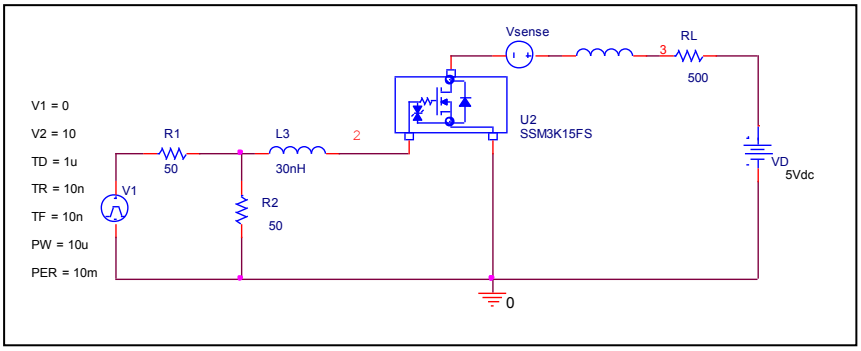
Switching Time Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=10mA, V_{DD}= 5V, V_{GS}=0/5V	Measurement		Simulation		Error(%)
Td(on)	50.000	ns	50.015	ns	0.03

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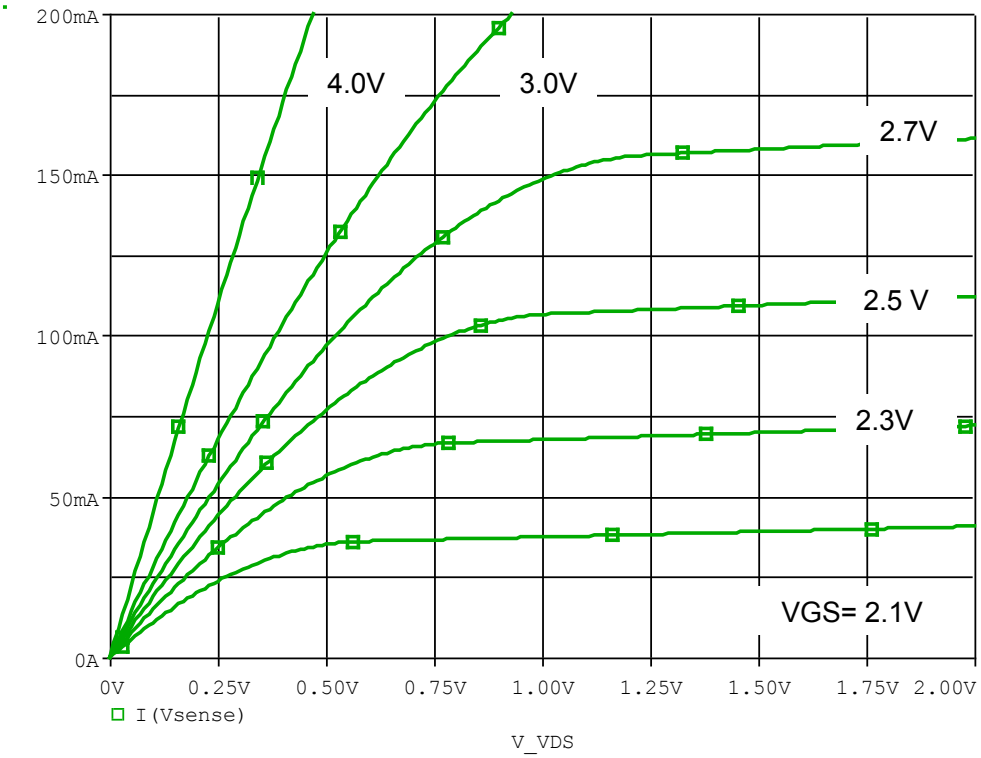
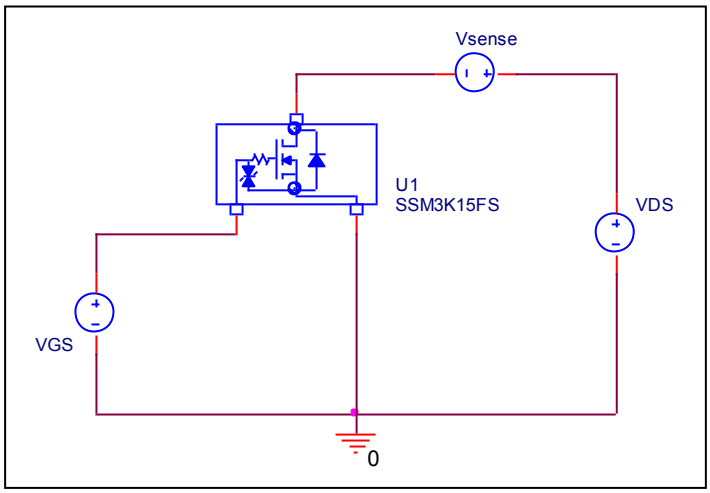
Output Characteristic

Circuit Simulation result



Evaluation circuit



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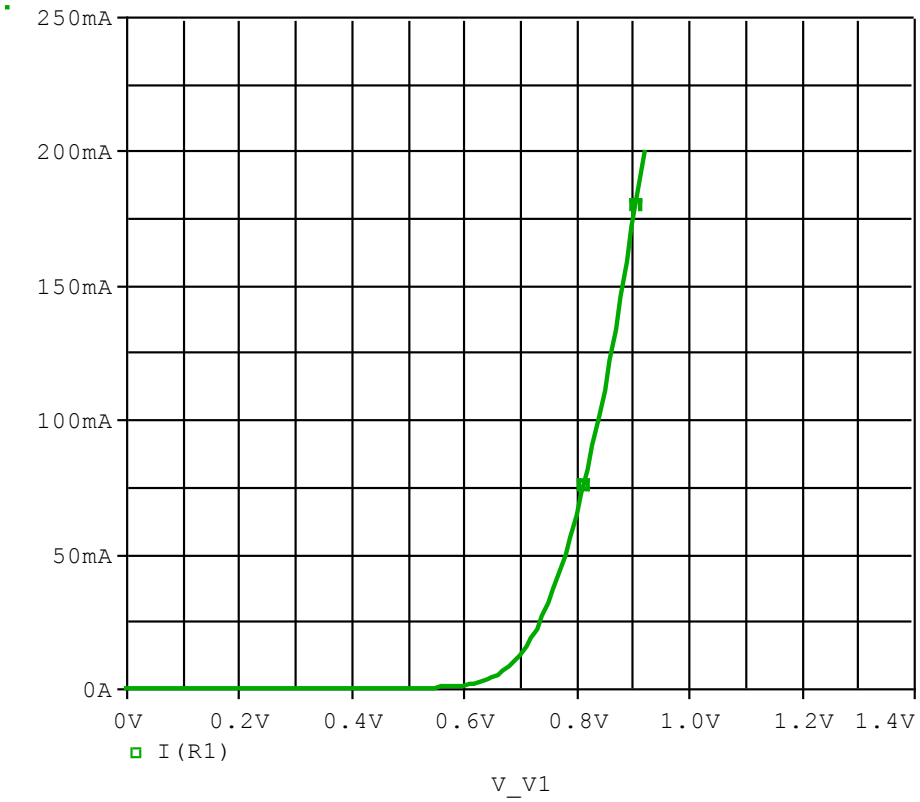
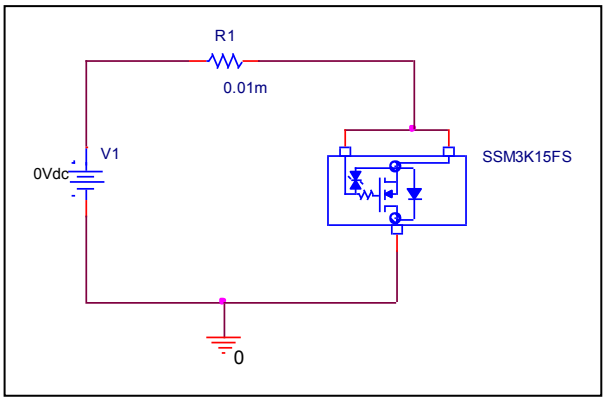
Forward Current Characteristic

Circuit Simulation Result



Evaluation Circuit



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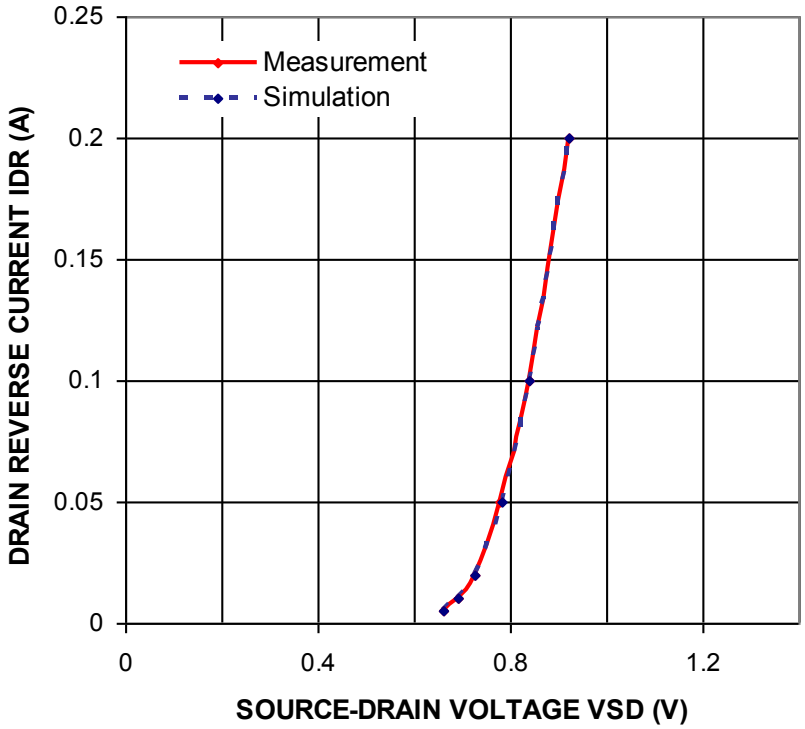
Comparison Graph

Circuit Simulation Result



Simulation Result

IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
0.005	0.6600	0.6599	-0.0152
0.010	0.6900	0.6902	0.0290
0.020	0.7250	0.7241	-0.1241
0.050	0.7800	0.7807	0.0897
0.100	0.8400	0.8395	-0.0595
0.200	0.9200	0.9200	0.0000

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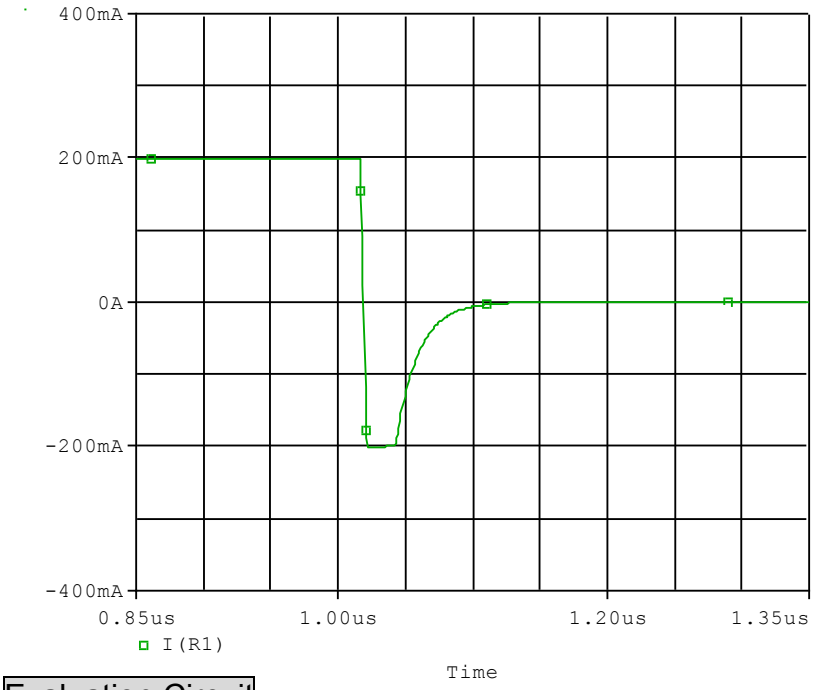
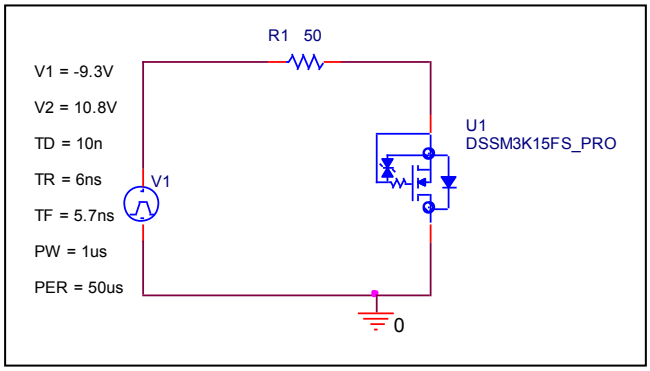
Reverse Recovery Characteristic (Body Diode)

Circuit Simulation Result



Evaluation Circuit



Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	24.000	ns	24.010	ns	0.0417
trb	37.600	ns	37.760	ns	0.4255
trr	61.600	ns	61.790	ns	0.3084

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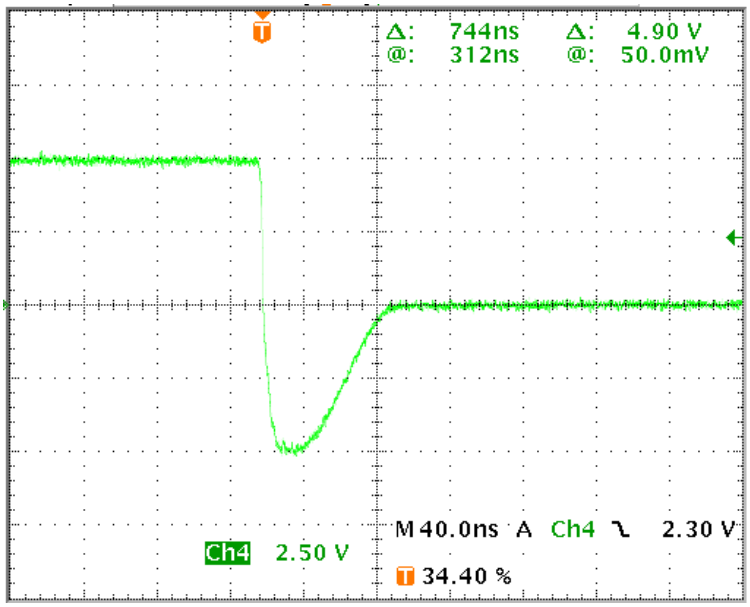
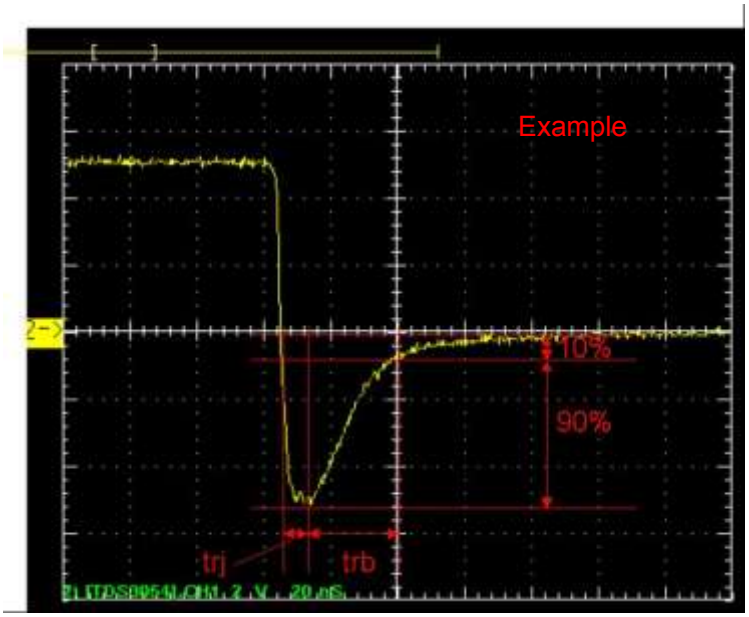
Reverse Recovery Characteristic (Body Diode) Reference



Trj= (24.ns)
Trb= (37.6ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



Relation between trj and trb

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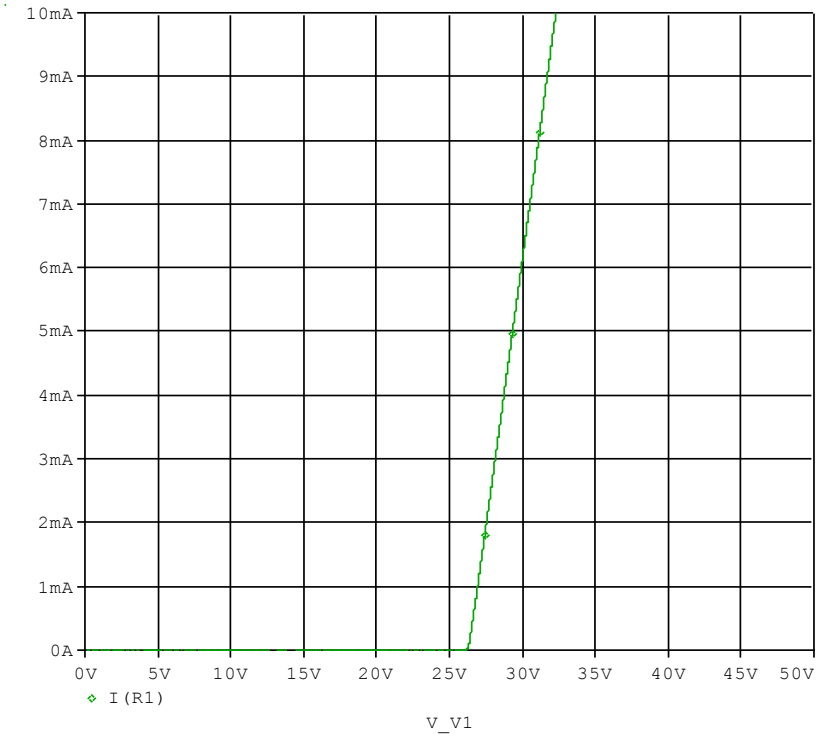
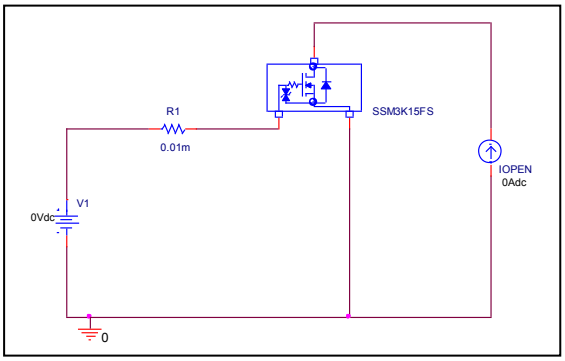
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



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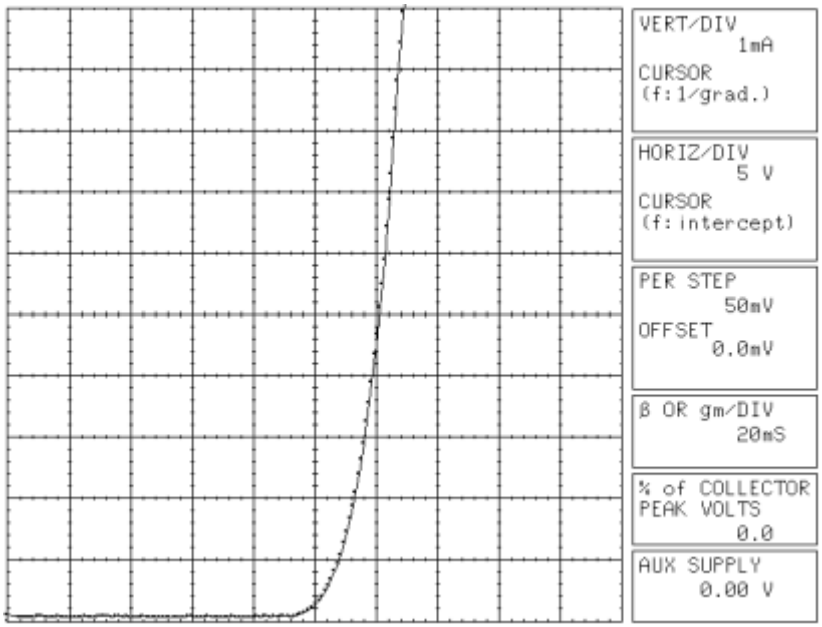
Zener Voltage Characteristic Reference



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