Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: SSM3K15FU
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

Bee Technologies Inc.

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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

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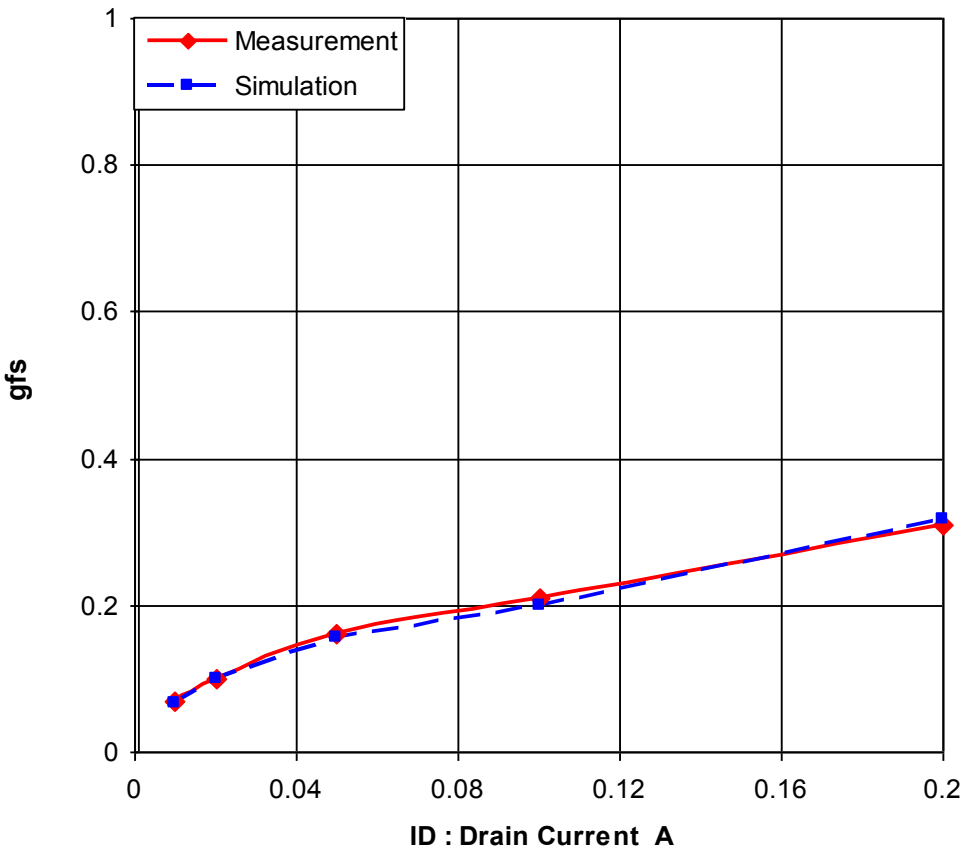
Transconductance Characteristic

Circuit Simulation Result



Comparison table

Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.010	0.069	0.067	-2.899
0.020	0.100	0.100	0.000
0.050	0.162	0.156	-3.704
0.100	0.210	0.200	-4.762
0.200	0.310	0.317	2.258

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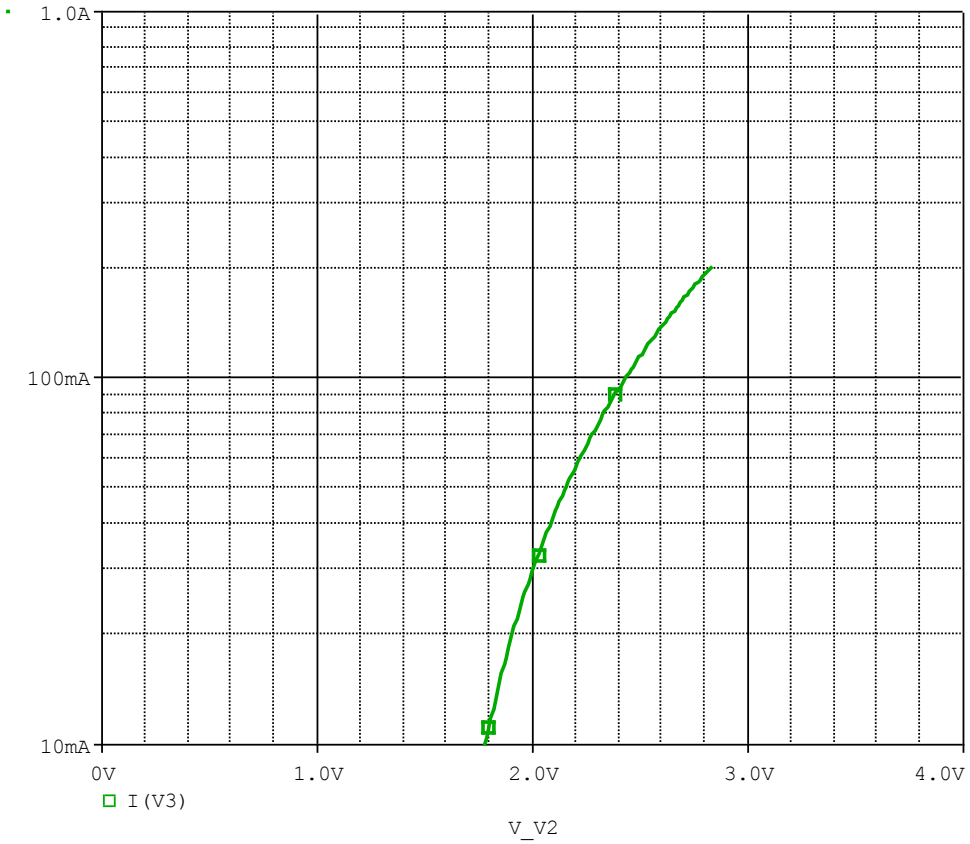
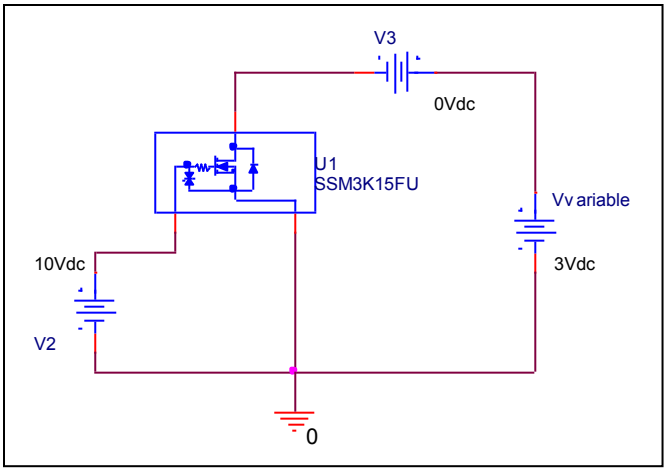
Vgs-Id Characteristic

Circuit Simulation result



Evaluation circuit



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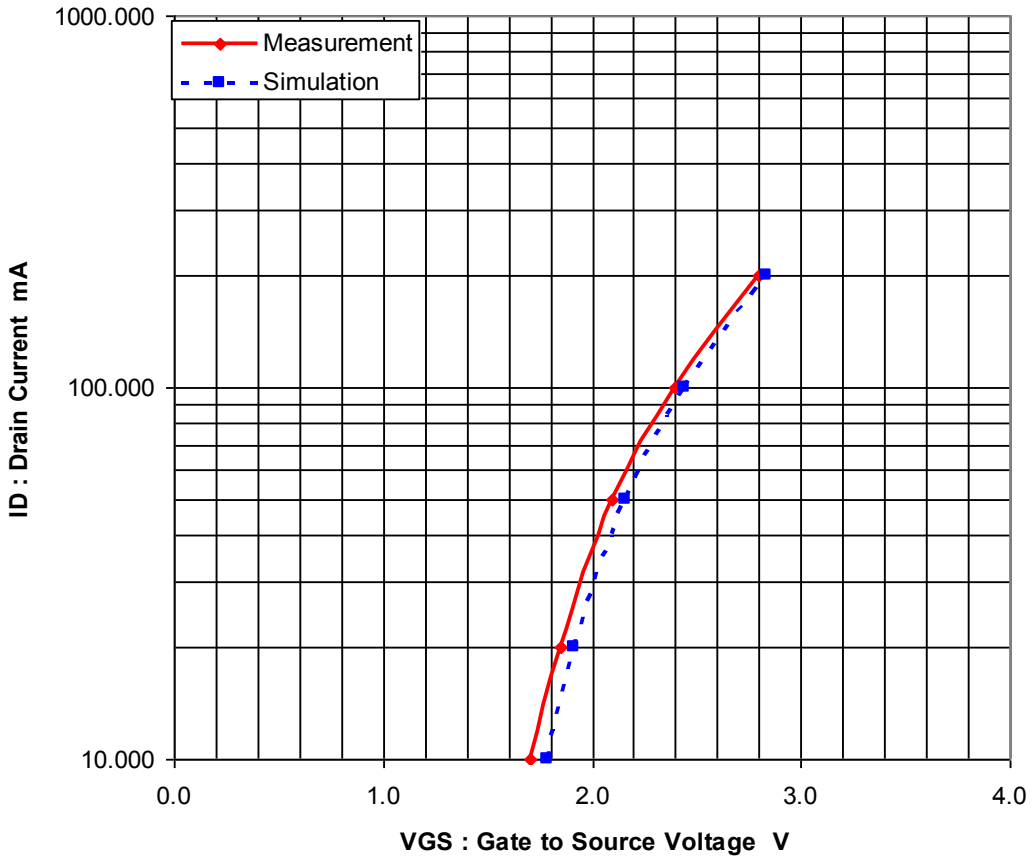
Comparison Graph

Circuit Simulation Result



Simulation Result

I_D(mA)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
10.000	1.700	1.785	5.000
20.000	1.850	1.911	3.297
50.000	2.100	2.159	2.810
100.000	2.400	2.439	1.625
200.000	2.800	2.831	1.107

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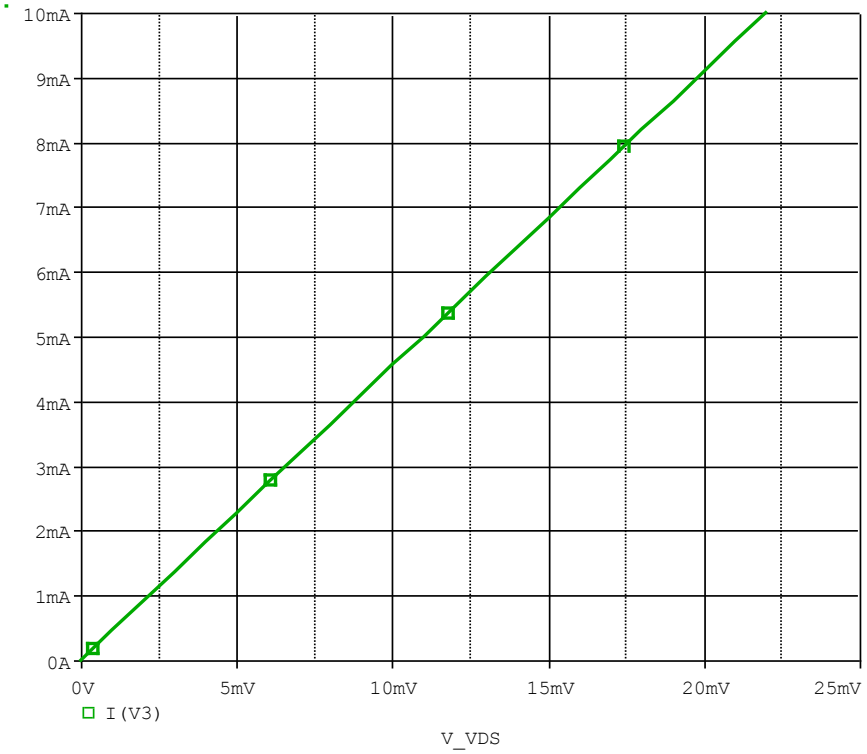
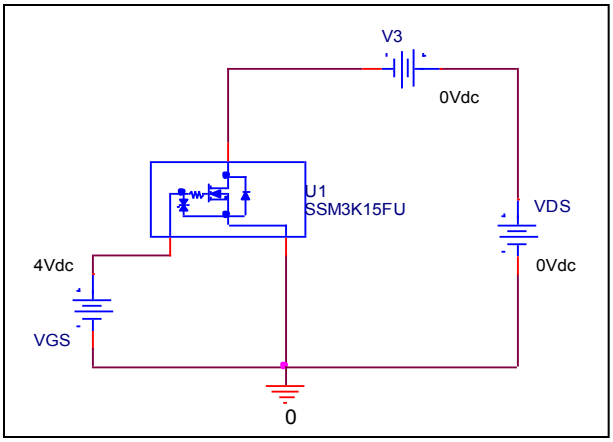
Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=10mA, V_{GS}=4V	Measurement	Simulation	Error (%)
R_{DS} (on) (Ω)	2.200	2.198	-0.091

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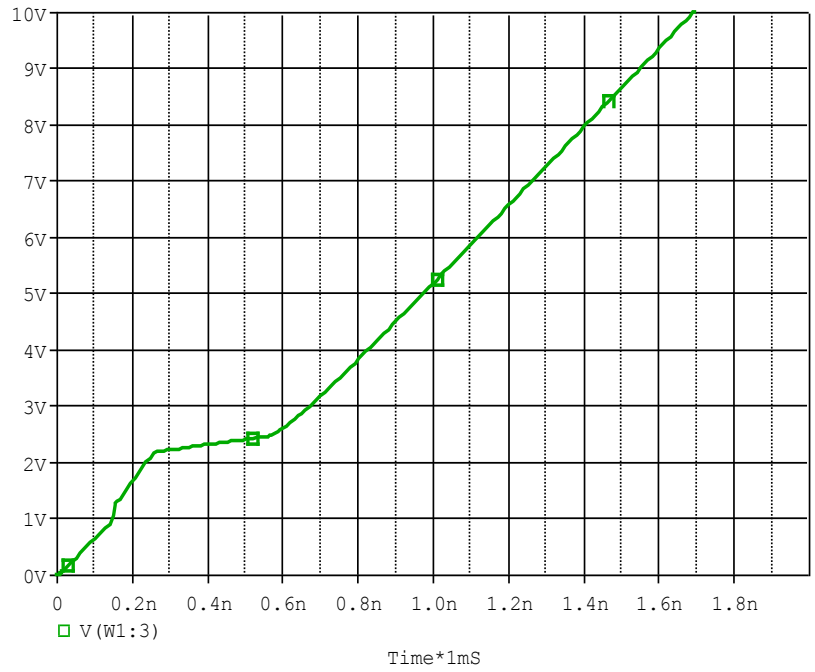
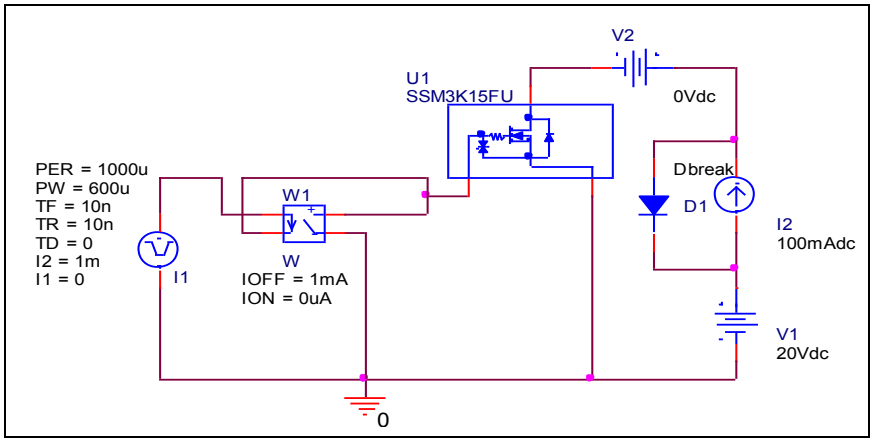
Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

V_{DD}=20V,I_D=100mA ,V_{GS}=10V	Measurement	Simulation	Error (%)
Qgs(nc)	0.260	0.259	-0.385
Qgd(nc)	0.300	0.303	1.000
Qg(nc)	1.700	1.695	-0.294

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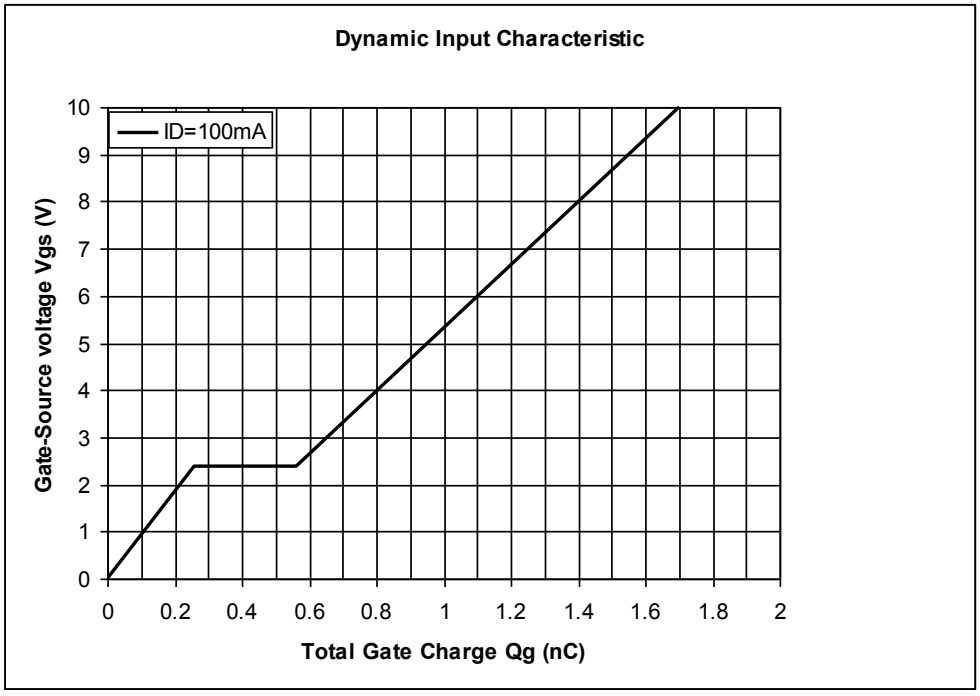
Gate Charge Characteristic Reference



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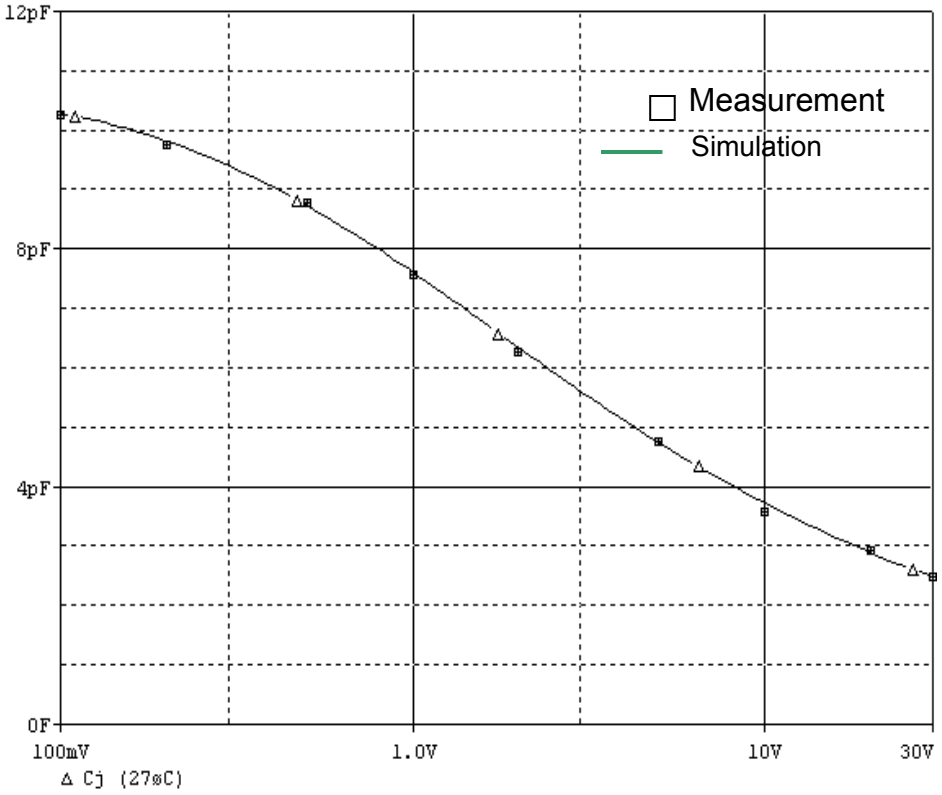
Capacitance Characteristic



Simulation Result

V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	10.300	10.299	-0.010
0.200	9.780	9.815	0.358
0.500	8.800	8.750	-0.568
1.000	7.600	7.610	0.132
2.000	6.300	6.340	0.635
5.000	4.800	4.740	-1.250
10.000	3.600	3.700	2.778
20.000	2.950	2.870	-2.712
30.0000	2.500	2.480	-0.800

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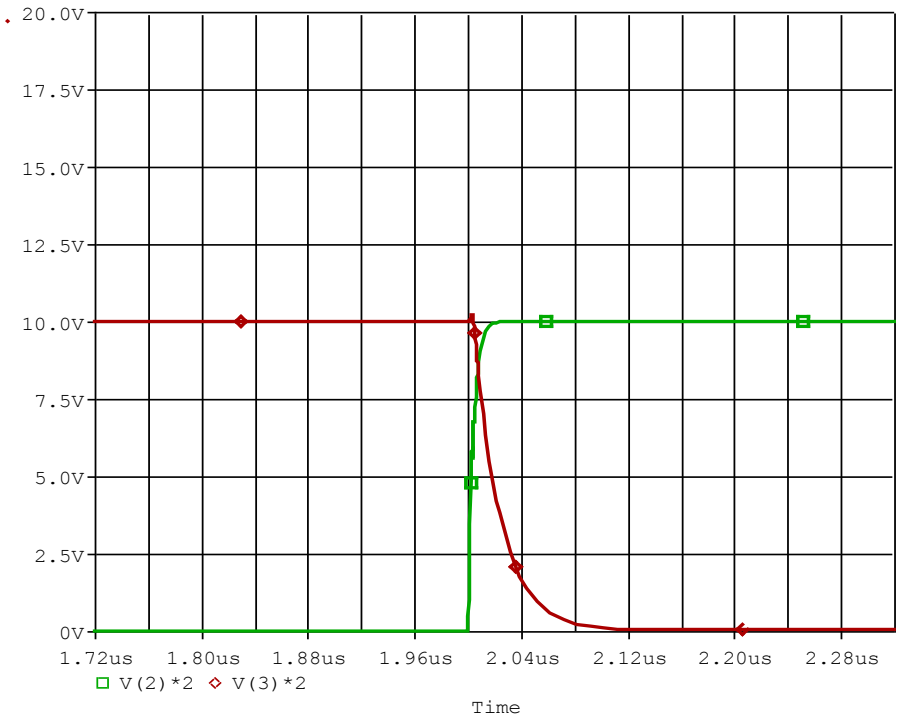
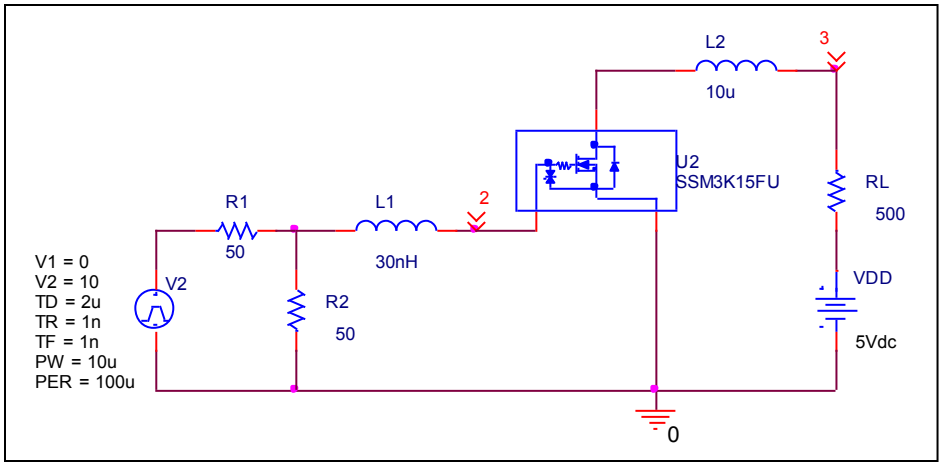
Switching Time Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=10mA, V_{DD}=5V V_{GS}=5V	Measurement	Simulation	Error(%)
Ton(ns)	14.000	14.002	0.014

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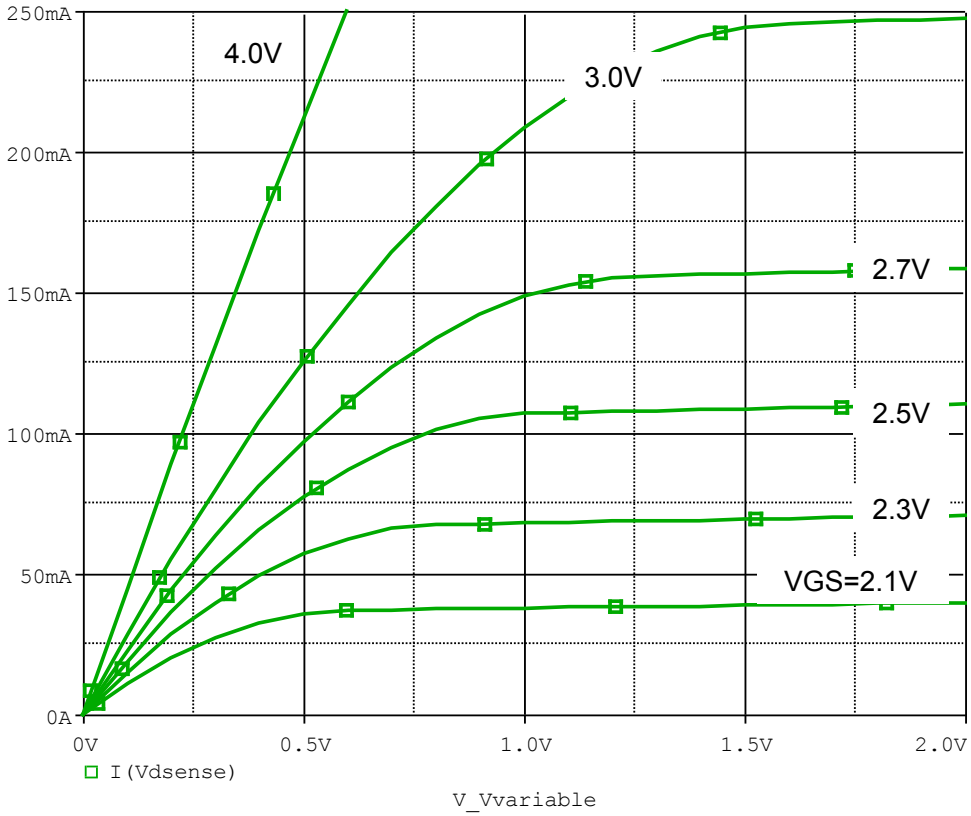
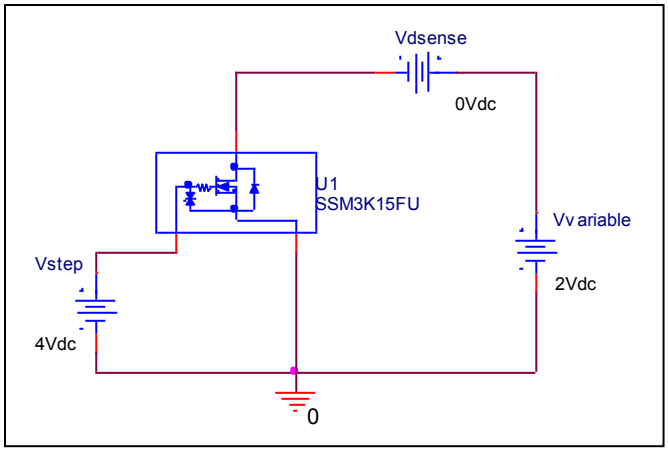
Output Characteristic

Circuit Simulation result



Evaluation circuit



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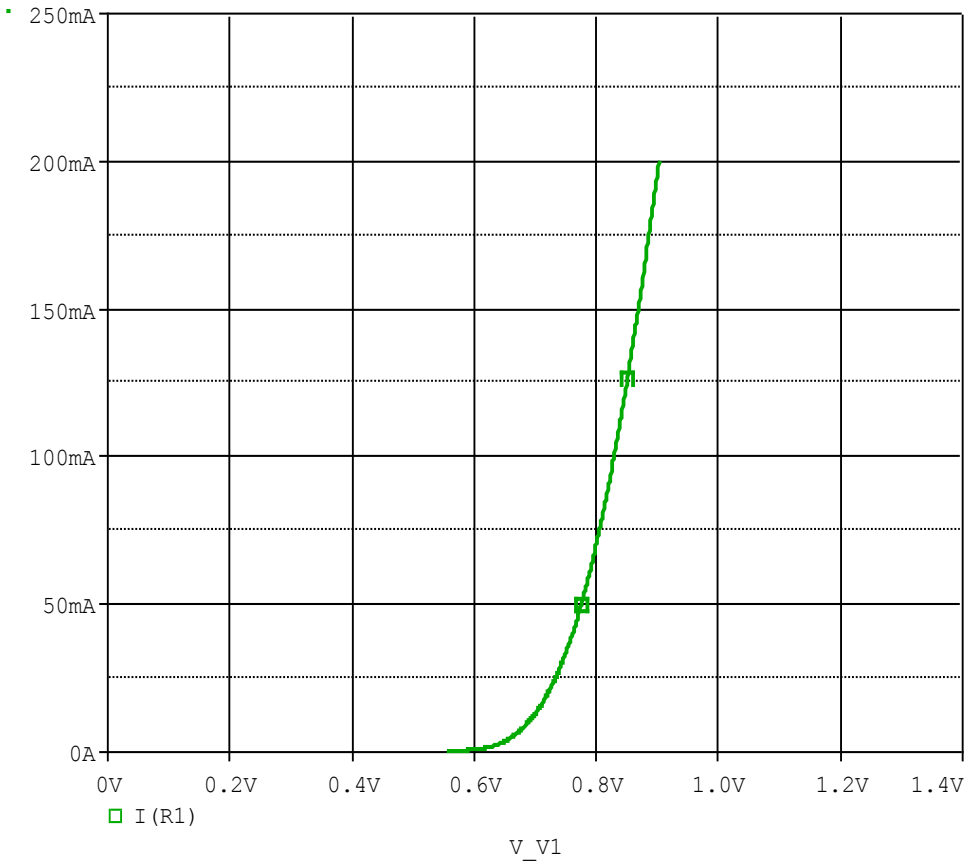
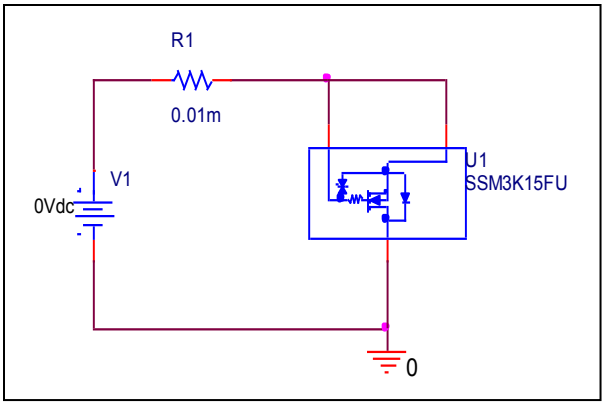
Forward Current Characteristic

Circuit Simulation Result



Evaluation Circuit



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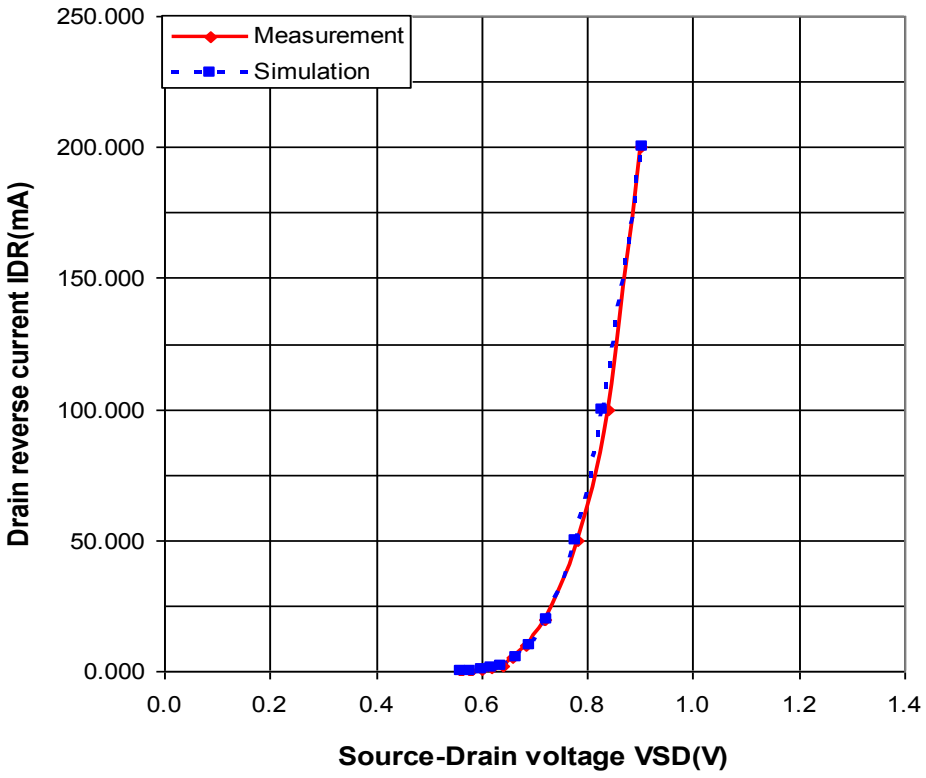
Comparison Graph

Circuit Simulation Result



Simulation Result

IDR(A)	VSD(V) Measurement	VSD(V) Simulation	%Error
0.100	0.560	0.561	0.179
0.200	0.580	0.578	-0.345
0.500	0.600	0.601	0.167
1.000	0.620	0.619	-0.161
2.000	0.640	0.637	-0.469
5.000	0.660	0.664	0.606
10.000	0.685	0.691	0.876
20.000	0.720	0.724	0.556
50.000	0.780	0.778	-0.256
100.000	0.840	0.830	-1.190
200.000	0.900	0.904	0.444

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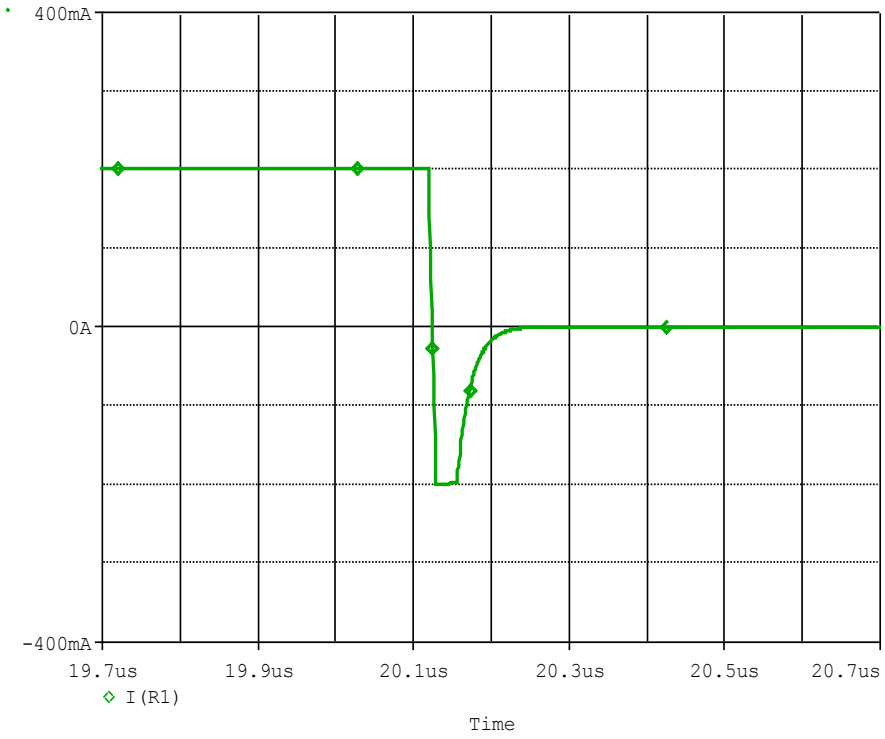
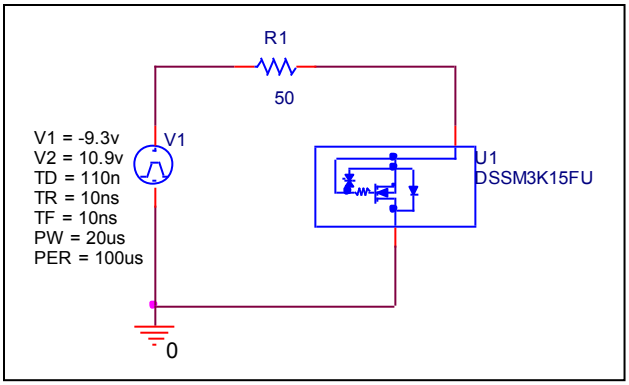
Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit



Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(ns)	**32.000**	**32.105**	**0.328**
trb(ns)	**41.600**	**41.800**	**0.481**
trr(ns)	**73.600**	**73.905**	**0.414**

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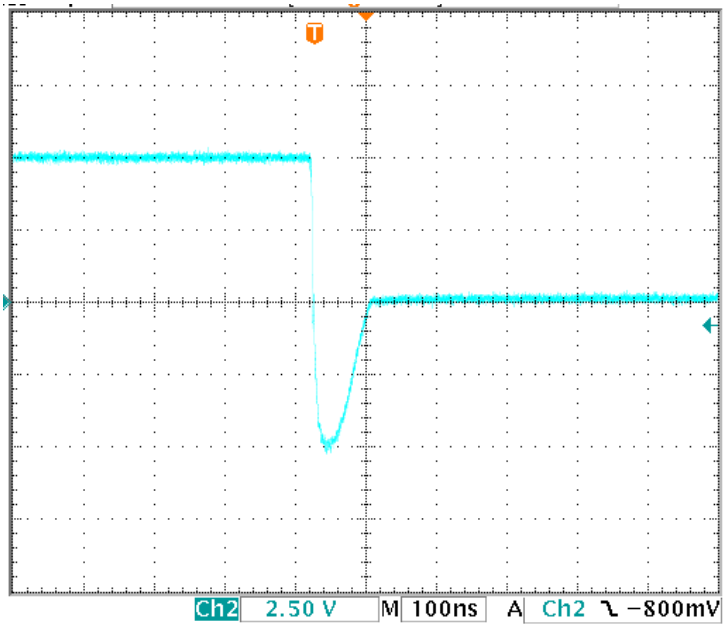
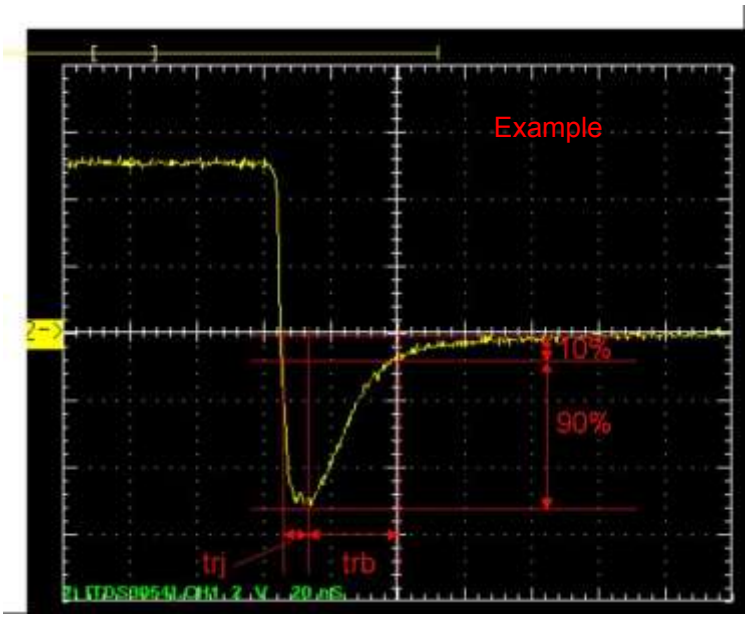
Reverse Recovery Characteristic Reference



Trj=32(ns)
Trb=41.6(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



Relation between trj and trb

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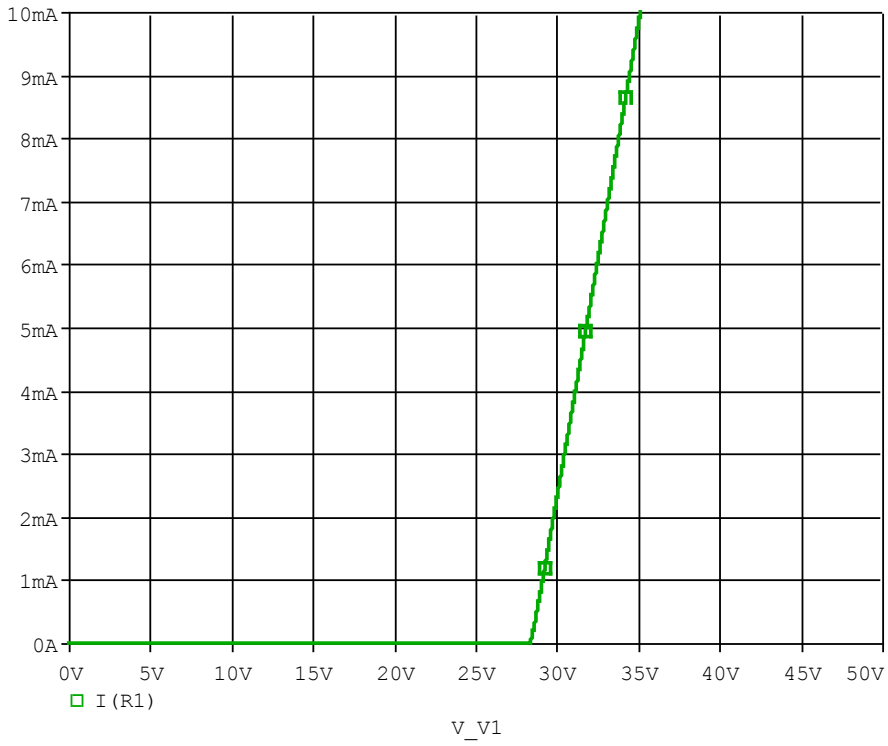
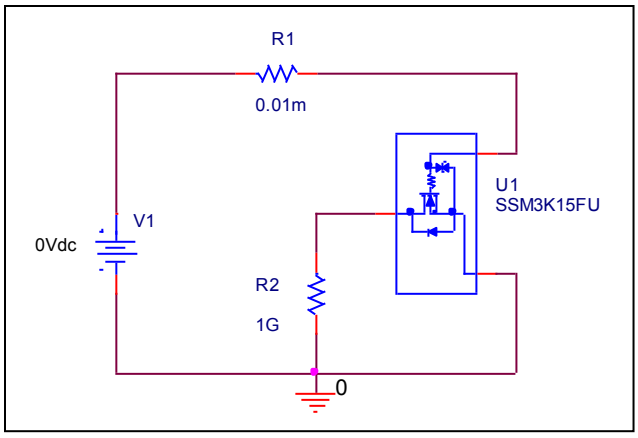
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



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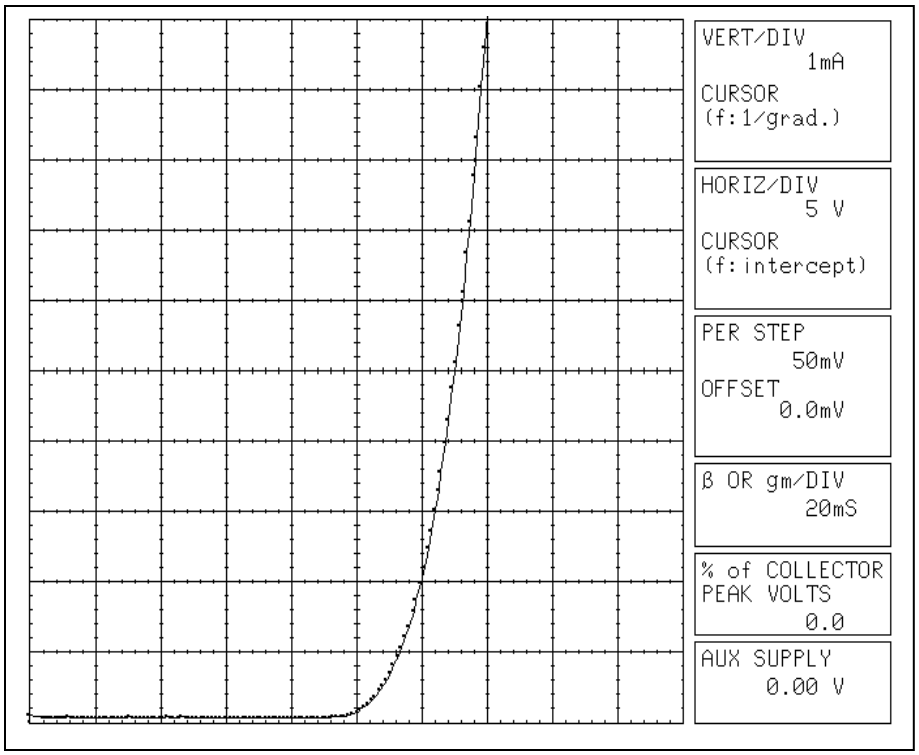
Zener Voltage Characteristic Reference



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