Device Modeling Report

COMPONENTS: Power MOSFET (Model parameter)
PART NUMBER: 2SK2962
MANUFACTURER: TOSHIBA
Body Diode (Model parameter) / 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	Mobility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

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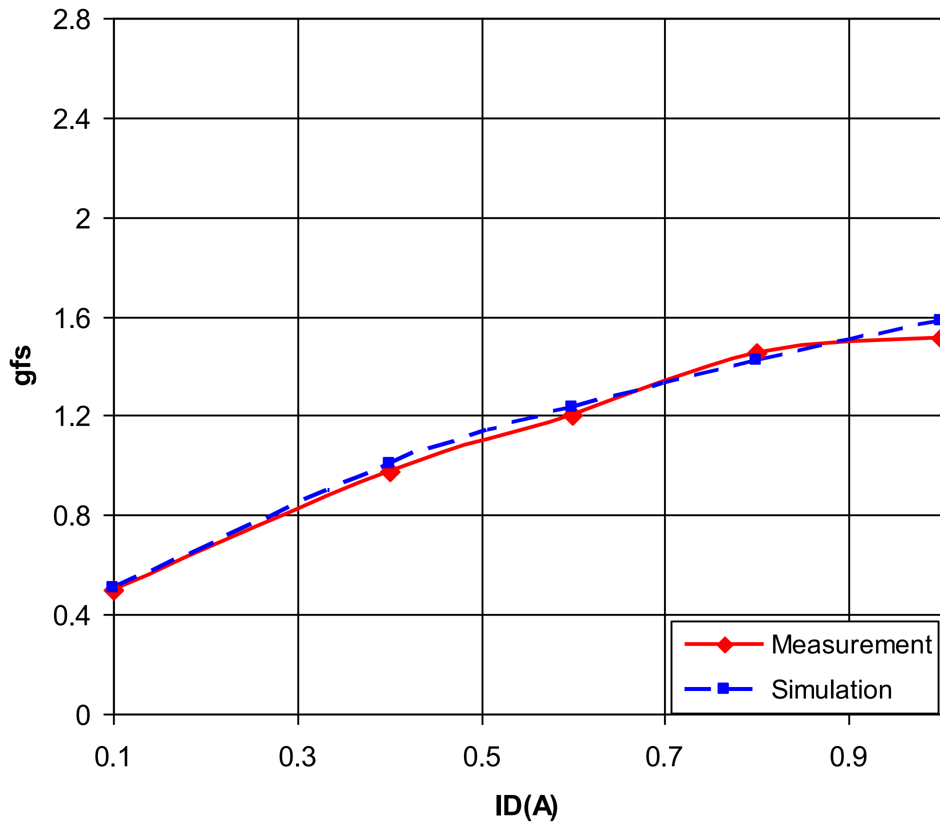
Transconductance Characteristic

Circuit Simulation Result



Comparison table

Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	0.5	0.508	1.600
0.4	0.977	1.010	3.378
0.6	1.2	1.232	2.667
0.8	1.455	1.421	-2.337
1	1.515	1.585	4.620

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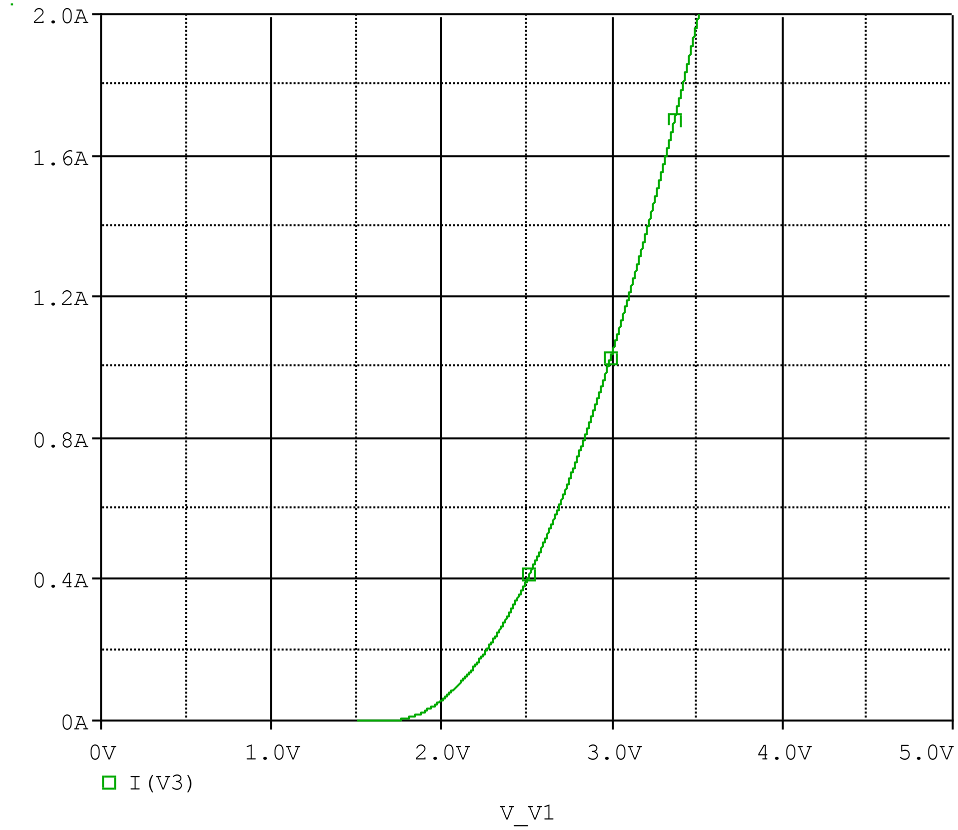
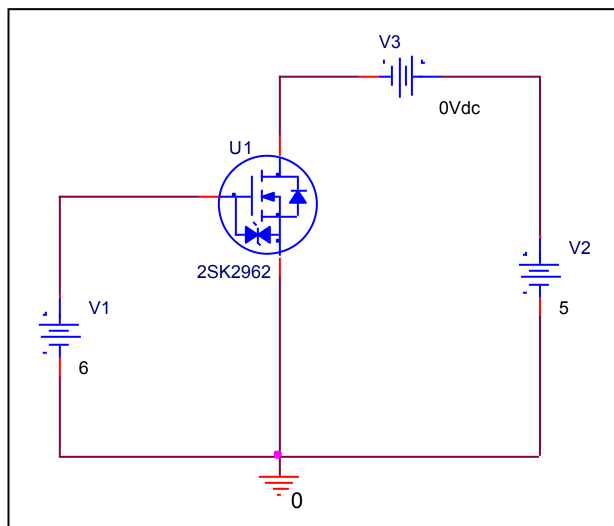
Vgs-Id Characteristic

Circuit Simulation result



Evaluation circuit



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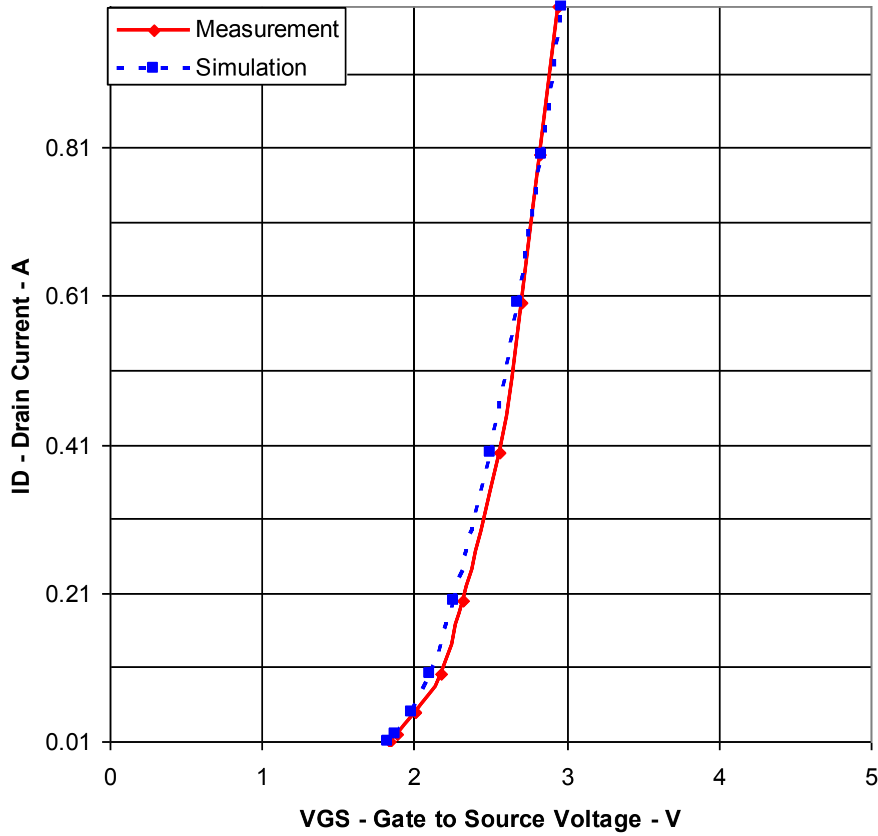
Comparison Graph

Circuit Simulation Result



Simulation Result

I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.01	1.84	1.821	-1.033
0.02	1.89	1.8723	-0.937
0.05	2.005	1.9786	-1.317
0.1	2.17	2.0967	-3.378
0.2	2.32	2.2642	-2.405
0.4	2.559	2.5015	-2.247
0.6	2.7	2.684	-0.593
0.8	2.825	2.8382	0.467
1	2.944	2.9743	1.029

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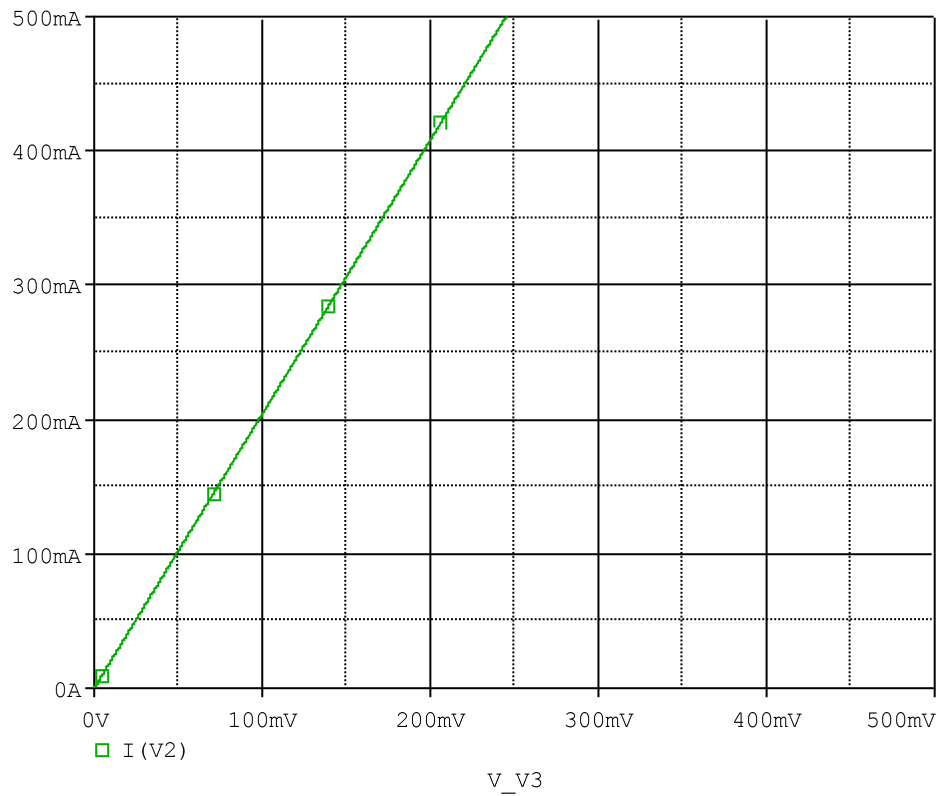
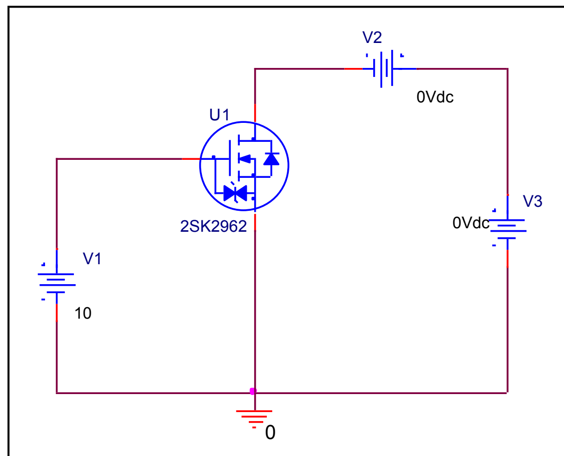
Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=0.5A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	0.5	Ω	0.49	Ω	-2

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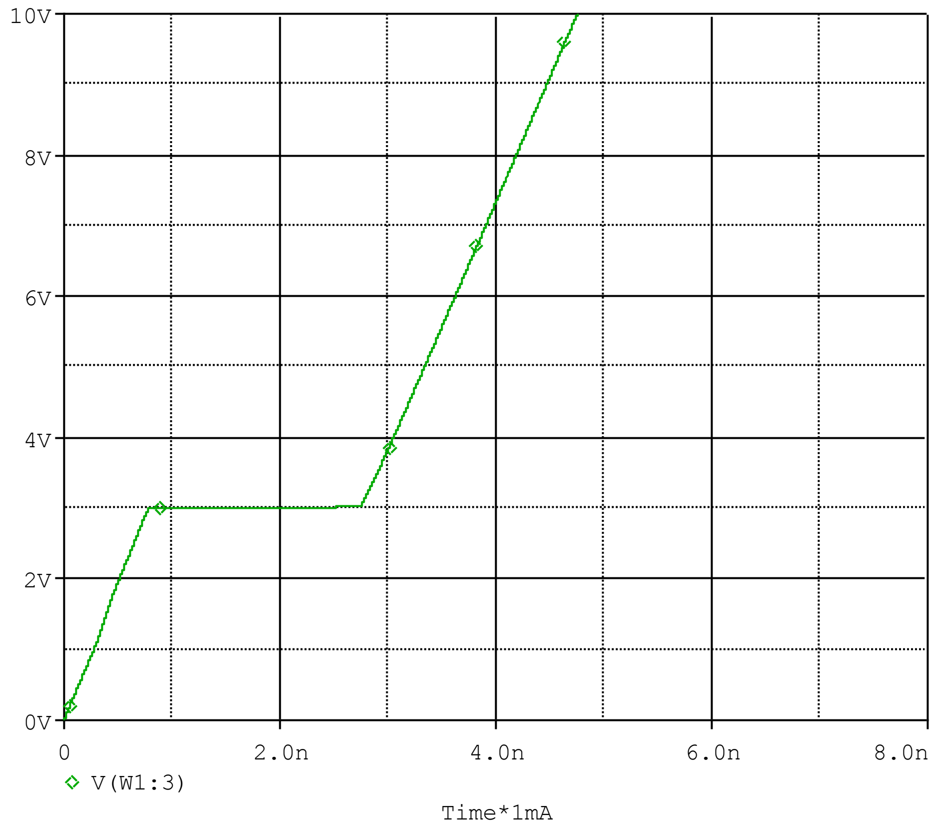
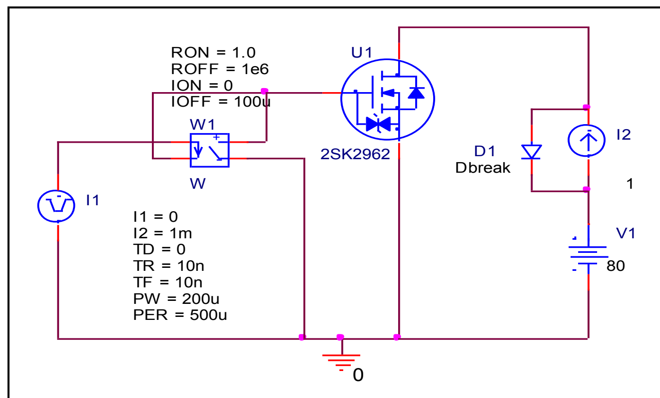
Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

V_{DD}=80V,I_D=1A	Measurement		Simulation		Error (%)
Qgs	0.8	nC	0.806	nC	0.750
Qgd	1.95	nC	1.9507	nC	0.036
Qg	6.35	nC	4.7965	nC	-24.465

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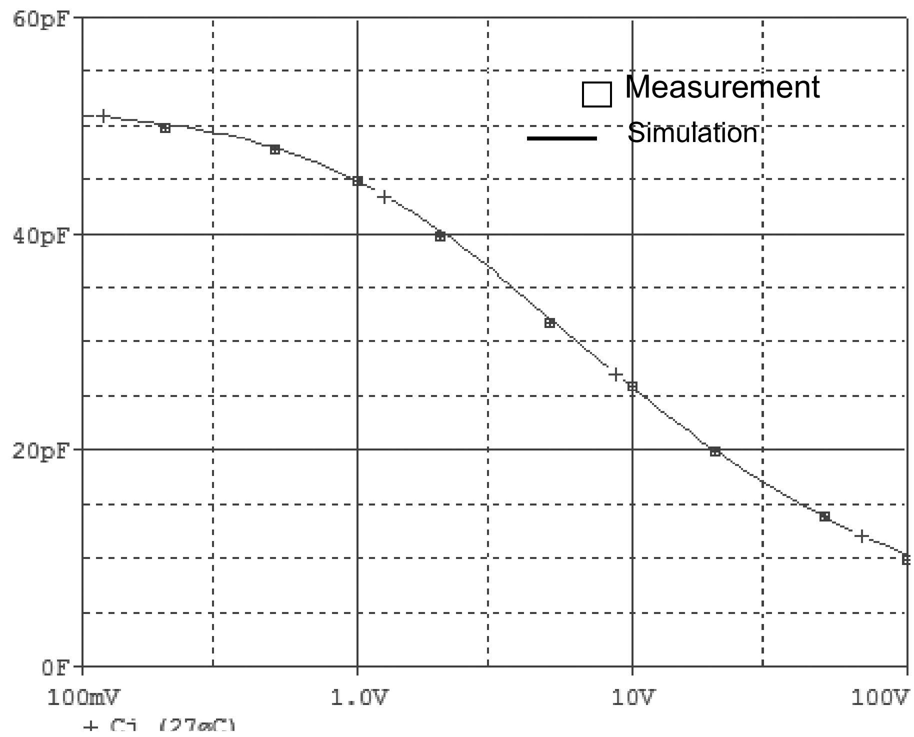
Capacitance Characteristic



Simulation Result

V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.2	50	50.2	0.400
0.5	48	47.8	-0.417
1	45	44.75	-0.556
2	40	40.2	0.500
5	32	32.2	0.625
10	26	25.8	-0.769
20	20	20	0.000
50	14	13.75	-1.786
100	10	10.2	2.000

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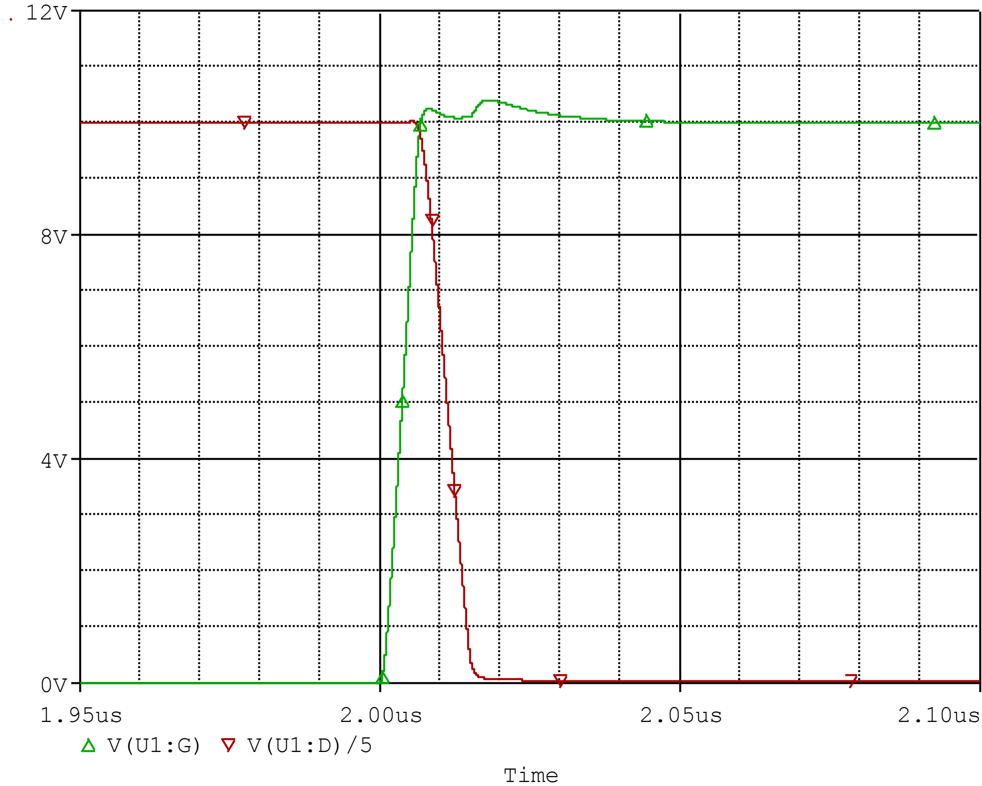
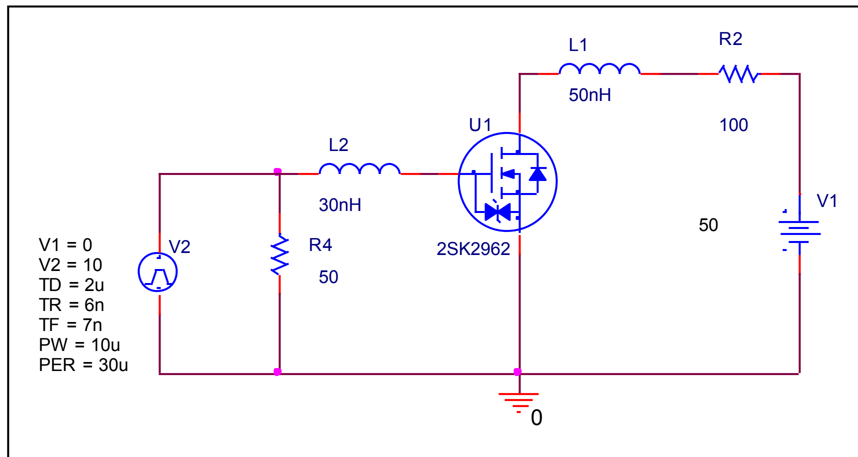
Switching Time Characteristic

Circuit Simulation result



Evaluation circuit



Simulation Result

I_D=0.5 A, V_{DD}=50V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	13.000	ns	13.167	ns	1.285

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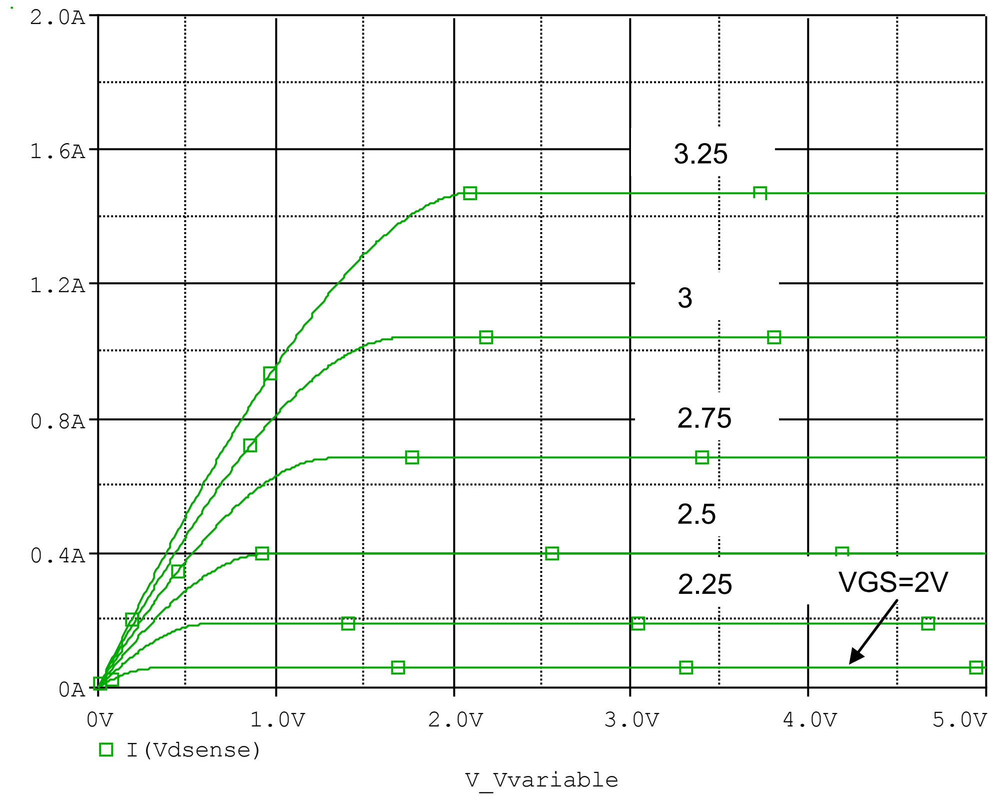
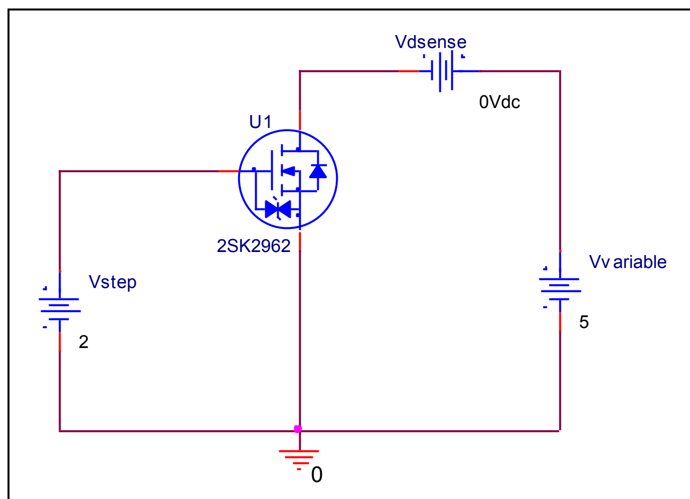
Output Characteristic

Circuit Simulation result



Evaluation circuit



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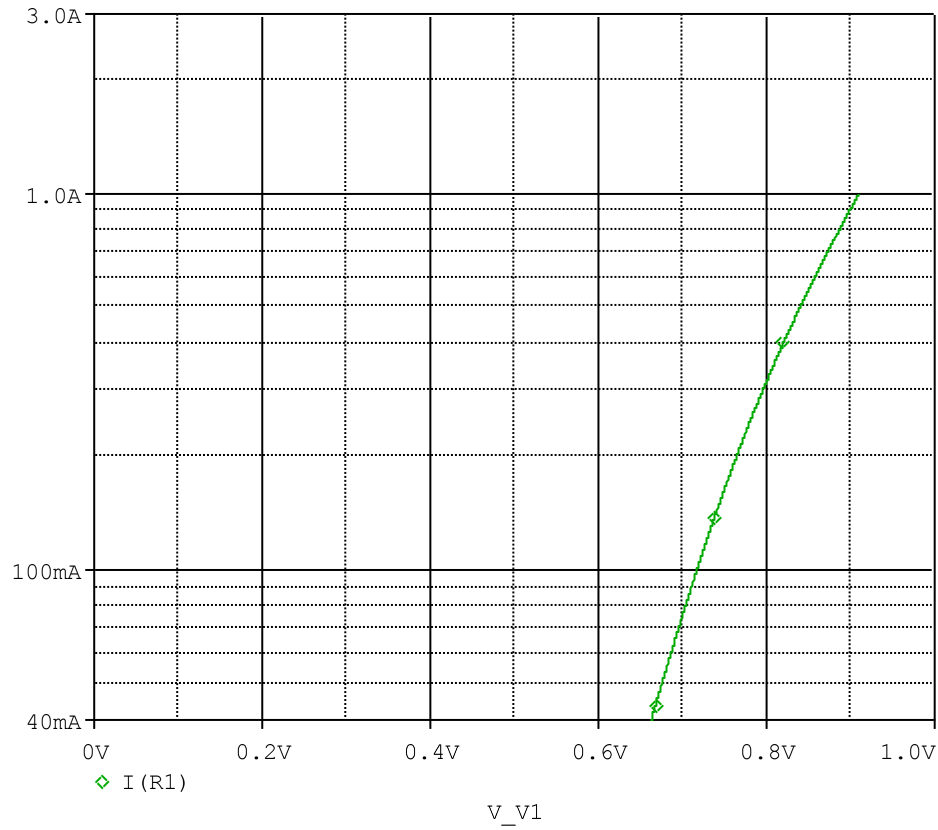
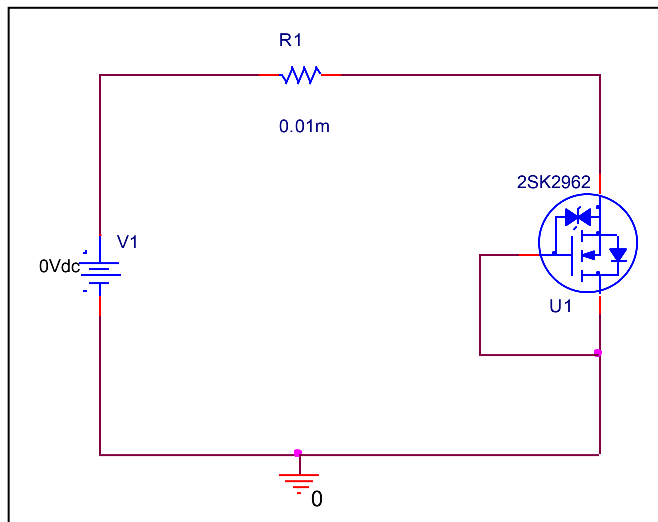
BODY DIODE
Forward Current Characteristic

Circuit Simulation Result



Evaluation Circuit



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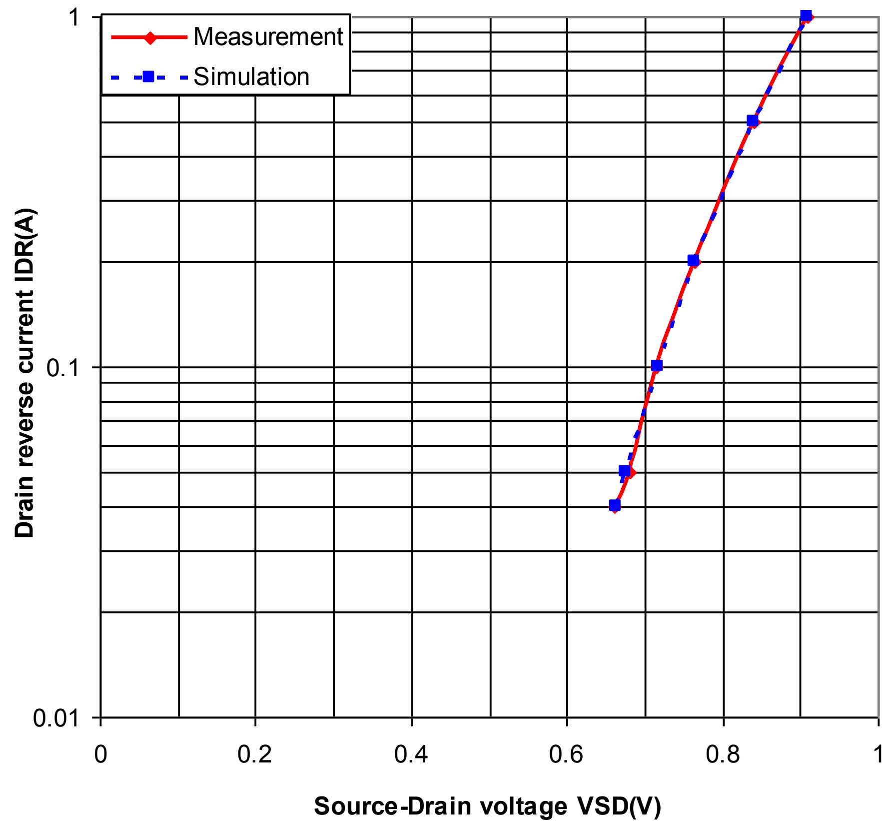
Comparison Graph

Circuit Simulation Result



Simulation Result

Ifwd(A)	VSD(V)		%Error
	Measuremen	Simulation	
0.04	0.66	0.663	0.455
0.05	0.68	0.676	-0.588
0.1	0.715	0.717	0.280
0.2	0.765	0.764	-0.131
0.5	0.84	0.840	0
1	0.91	0.91	0

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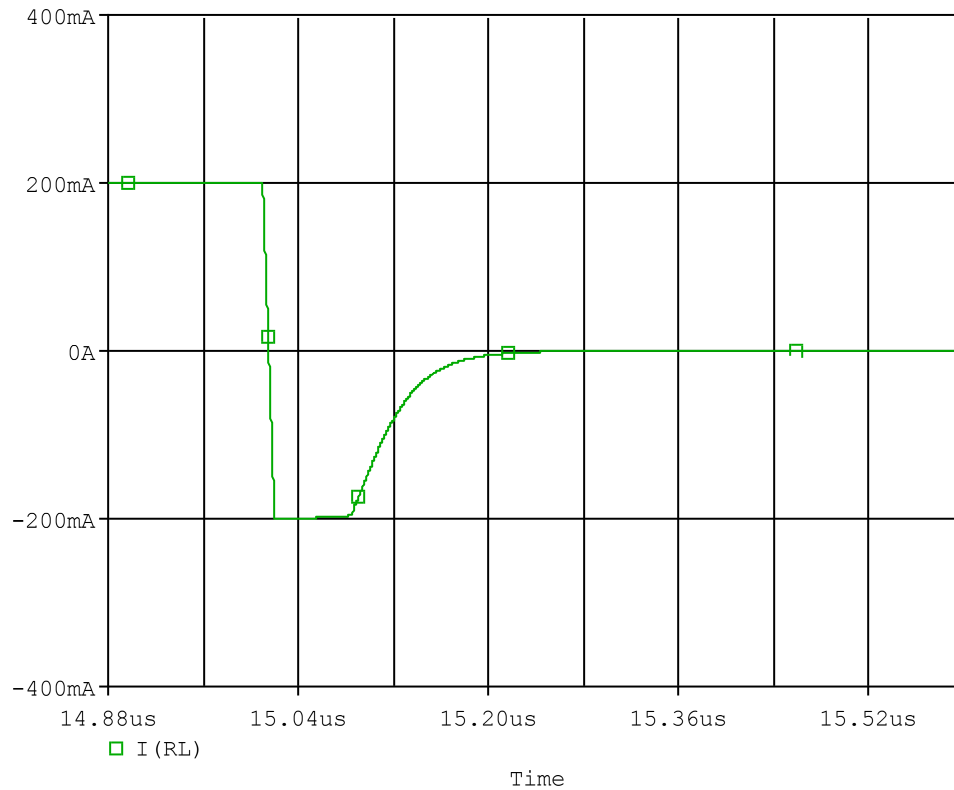
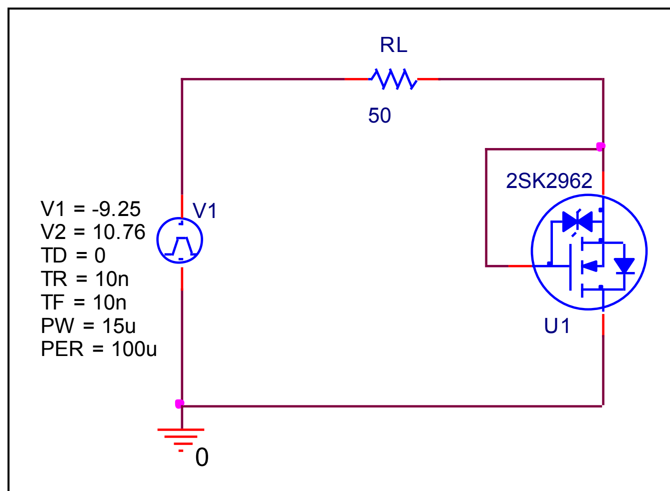
Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit



Compare Measurement vs. Simulation

Trr(ns)	Measurement	Simulation	Error (%)
Trj+Trb (ns)	146.4	146.888	0.333

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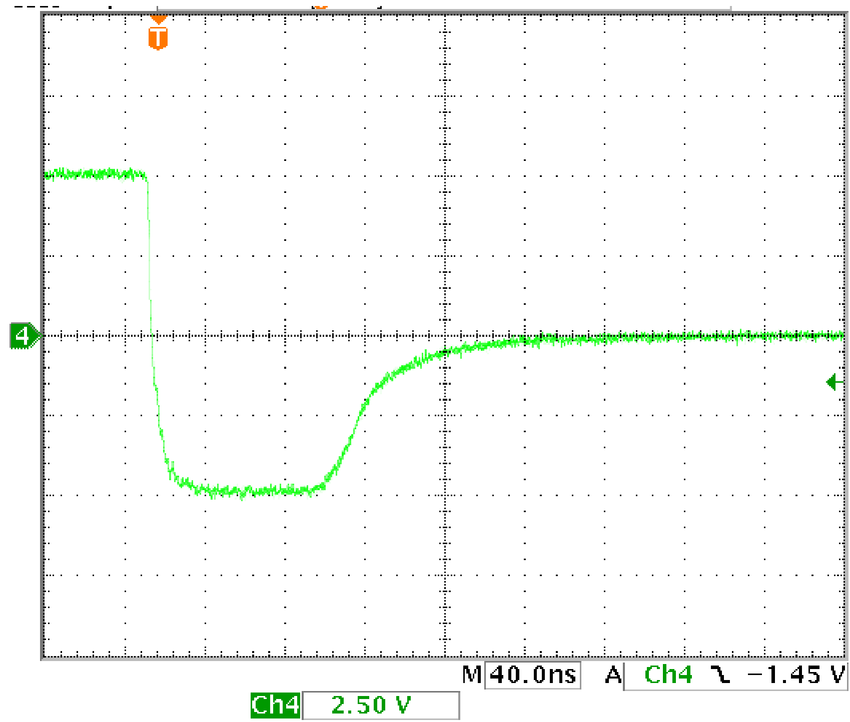
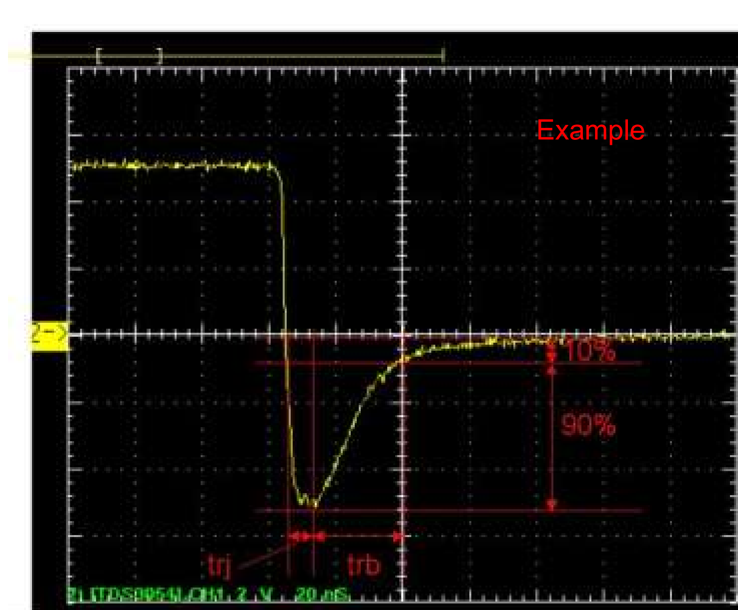
Reverse Recovery Characteristic **Reference**



Trj=79.2(ns)
Trb=67.2(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



Relation between trj and trb

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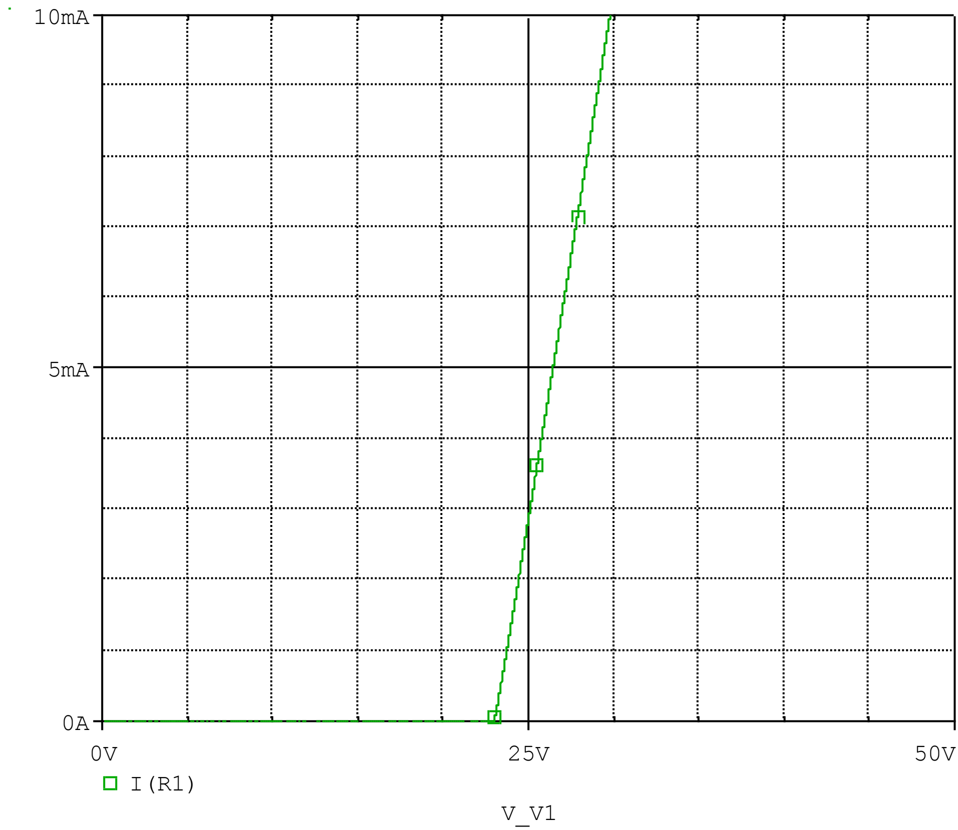
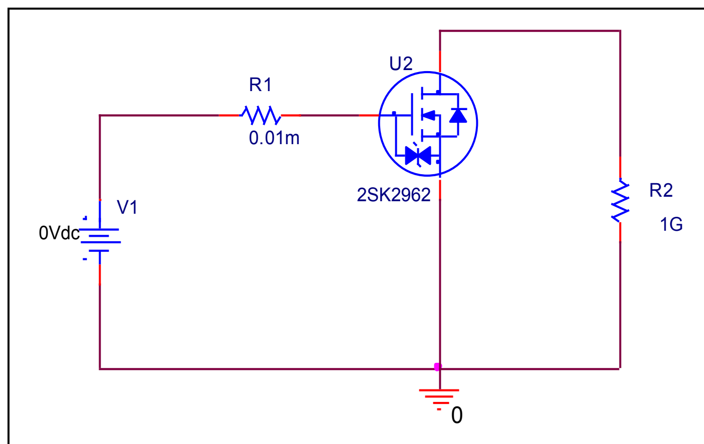
ESD PROTECTION DIODE
Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



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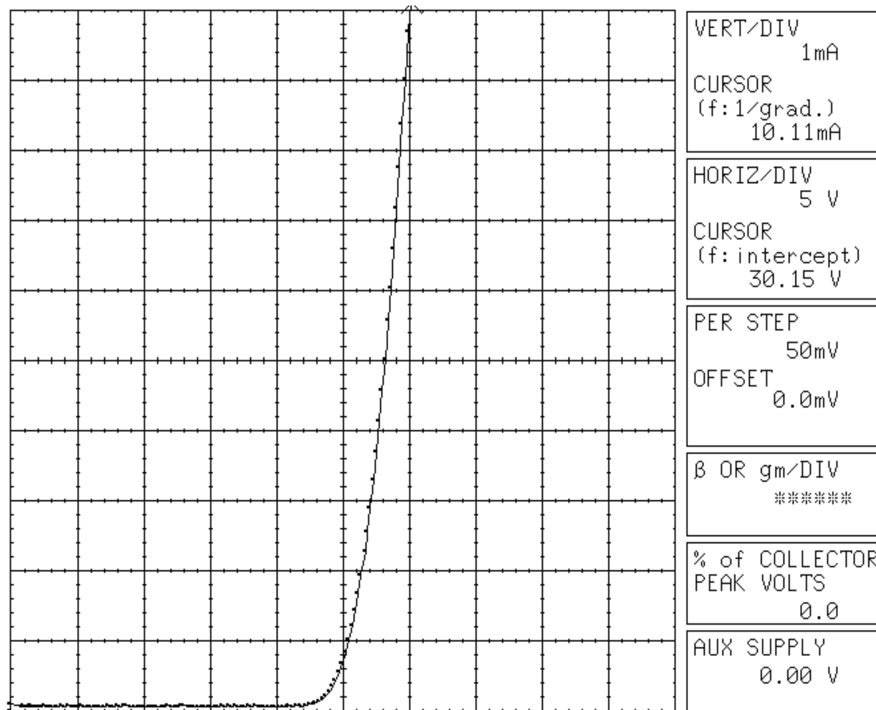
Zener Voltage Characteristic **Reference**



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