Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SJ438
MANUFACTURER: TOSHIBA
REMARK: P Channel Model
Body Diode (Professional) / ESD Protection Diode

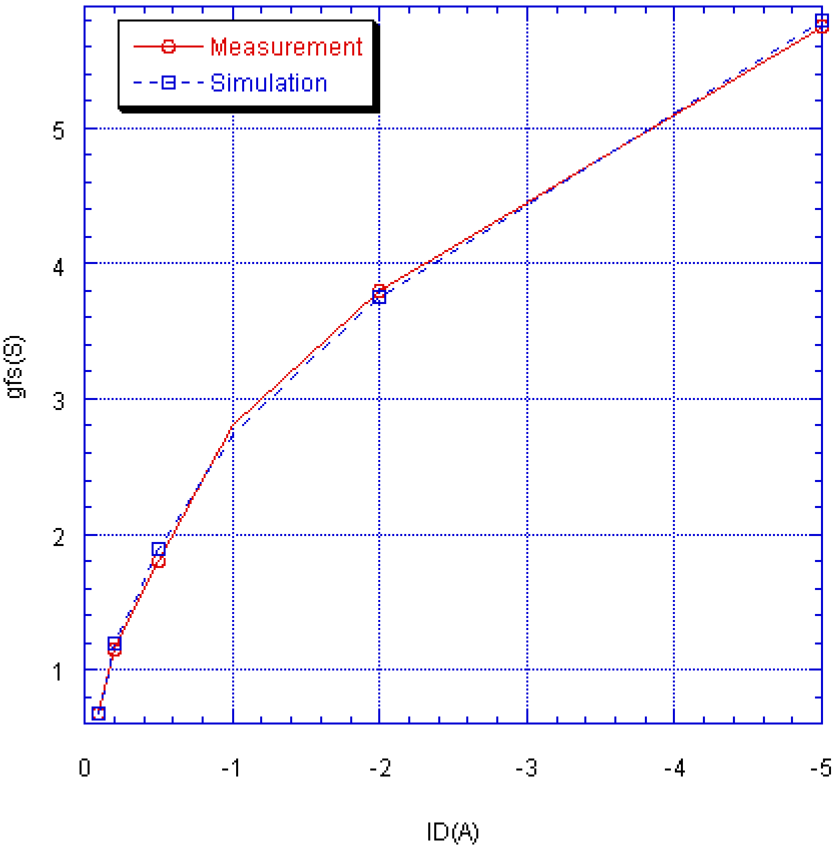
Bee Technologies Inc.

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

Transconductance Characteristic

Circuit Simulation Result

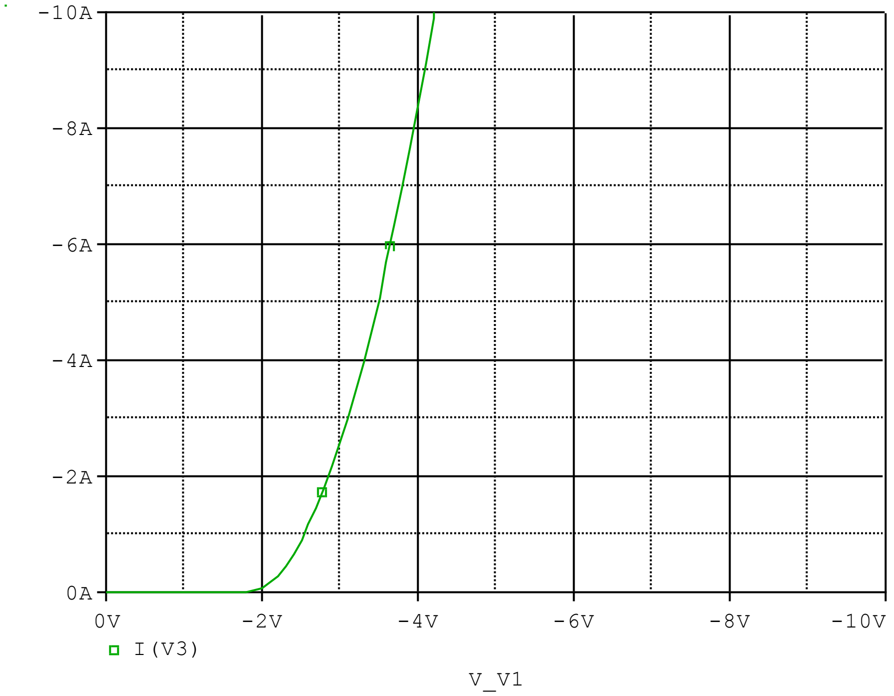


Comparison table

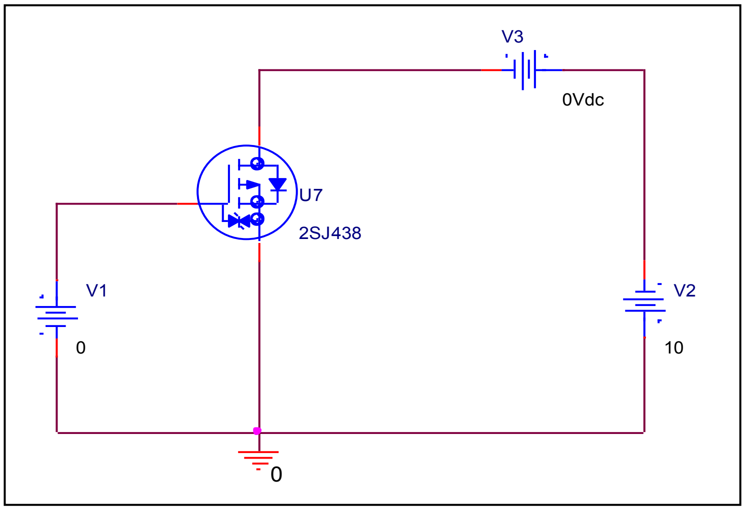
Id(A)	gfs		Error(%)
	Measurement	Simulation	
-0.100	**0.670**	**0.680**	**1.493**
-0.200	**1.150**	**1.200**	**4.348**
-0.500	**1.800**	**1.890**	**5.000**
-1.000	**2.800**	**2.740**	**-2.143**
-2.000	**3.800**	**3.750**	**-1.316**
-5.000	**5.750**	**5.800**	**0.870**

Vgs-Id Characteristic

Circuit Simulation result

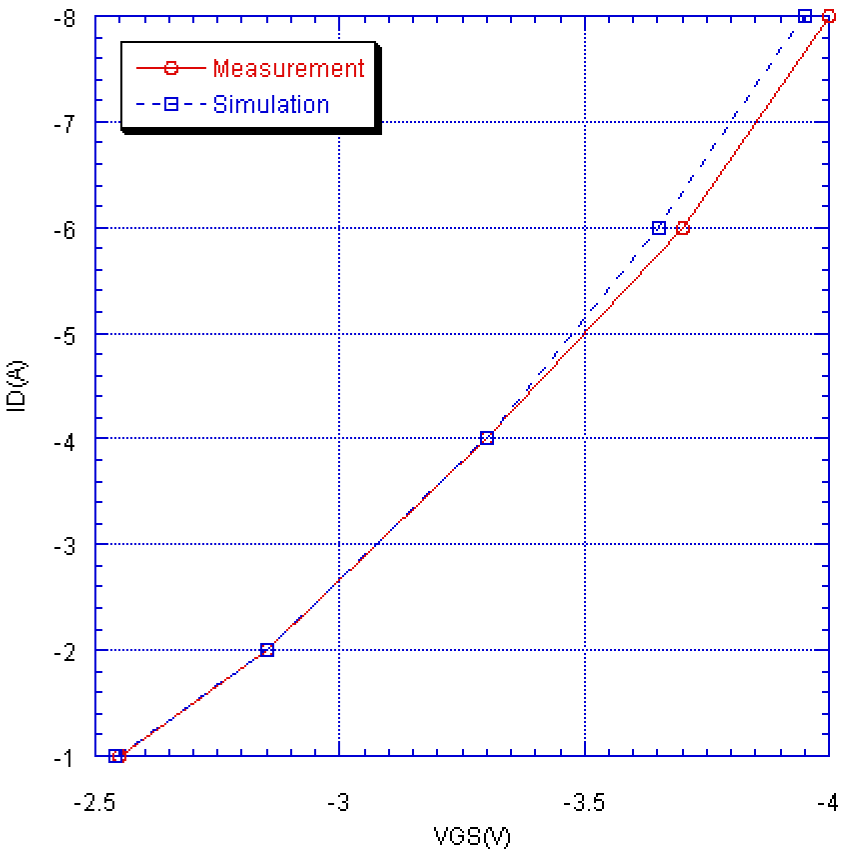


Evaluation circuit



Comparison Graph

Circuit Simulation Result

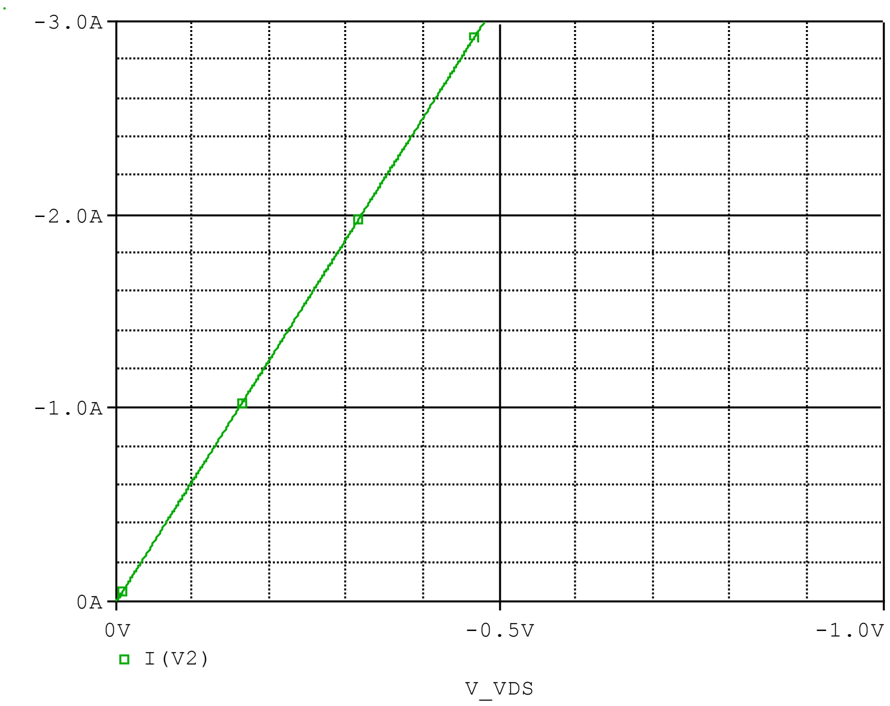


Simulation Result

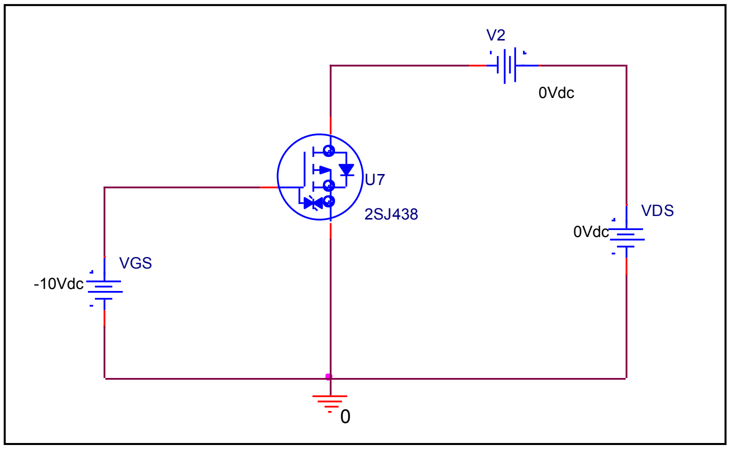
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
-1.000	-2.550	-2.540	-0.392
-2.000	-2.850	-2.853	0.105
-4.000	-3.300	-3.302	0.061
-6.000	-3.700	-3.653	-1.270
-8.000	-4.000	-3.949	-1.275

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

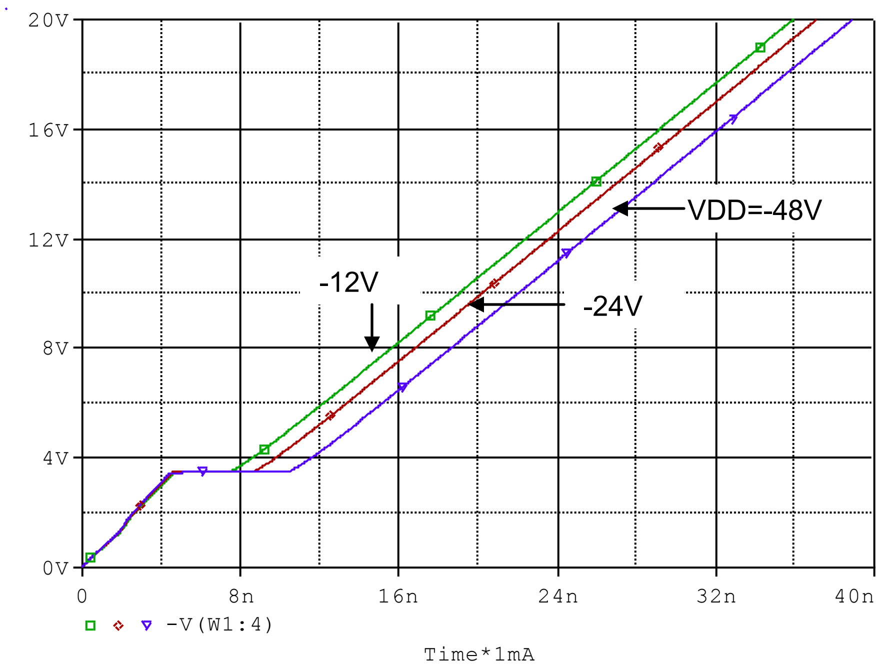


Simulation Result

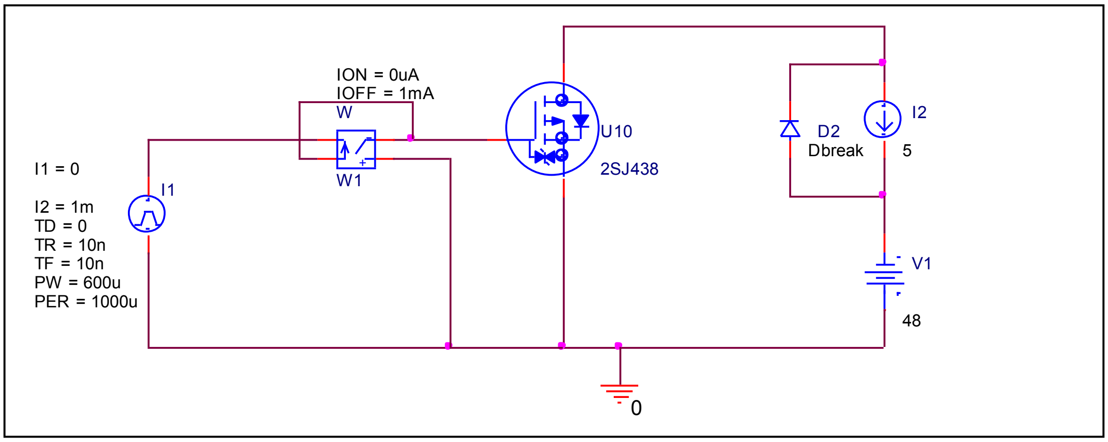
I_D=-2.5A, V_{GS}=-10V	Measurement		Simulation		Error (%)
R_{DS} (on)	160.000	mΩ	160.000	mΩ	0.000

Gate Charge Characteristic

Circuit Simulation result



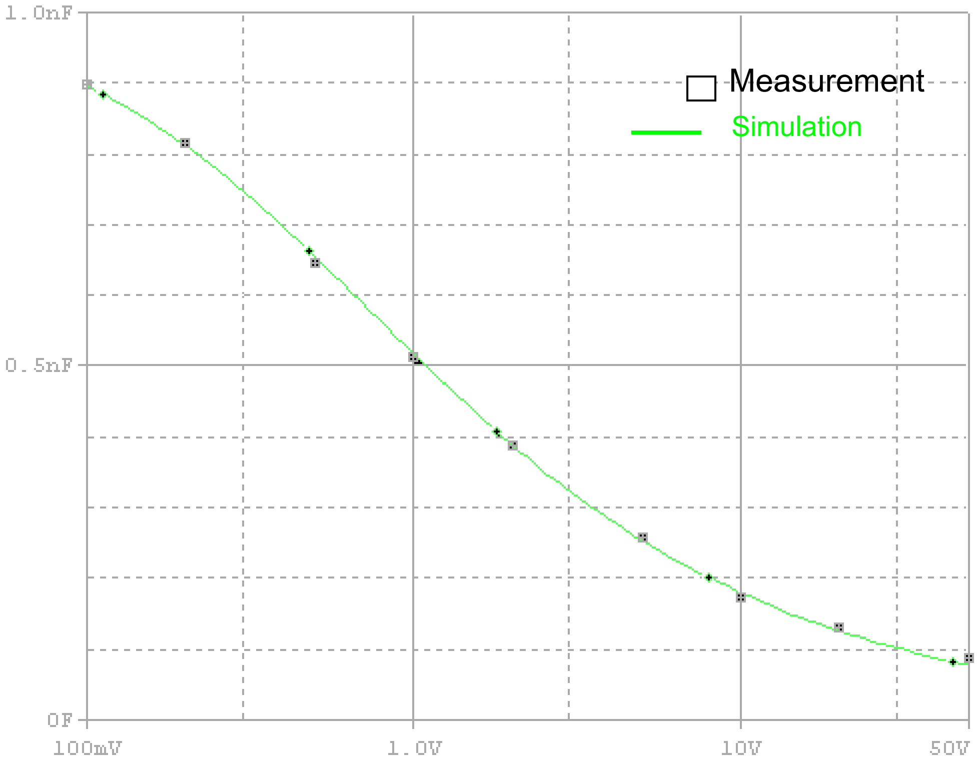
Evaluation circuit



Simulation Result

V_{DD}=-48V,I_D=-5A ,V_{GS}=-10V	Measurement		Simulation		Error (%)
Qgs	4.500	nC	4.504	nC	0.089
Qgd	6.000	nC	6.036	nC	0.600
Qg	22.000	nC	21.982	nC	-0.082

Capacitance Characteristic

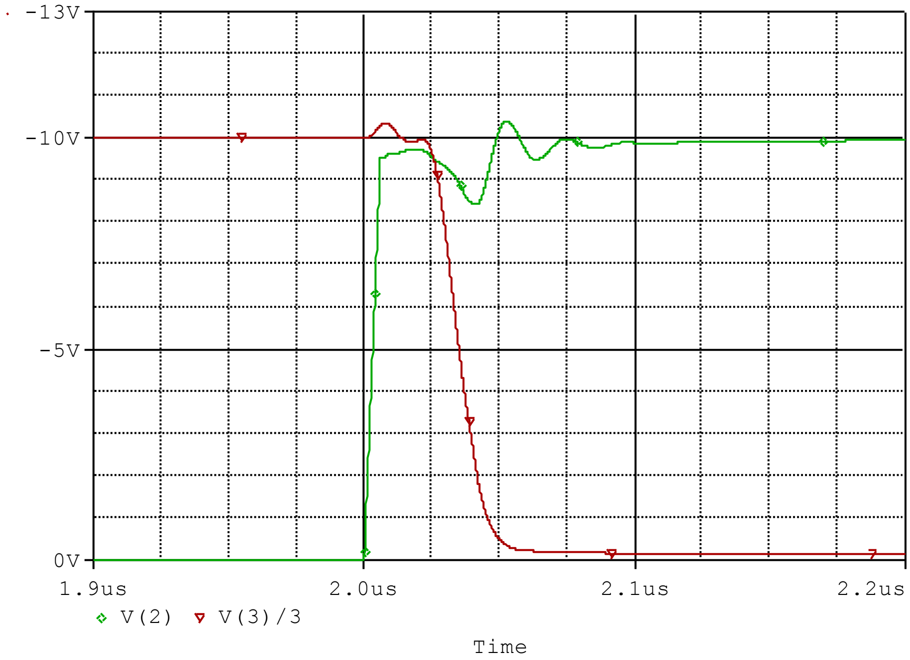


Simulation Result

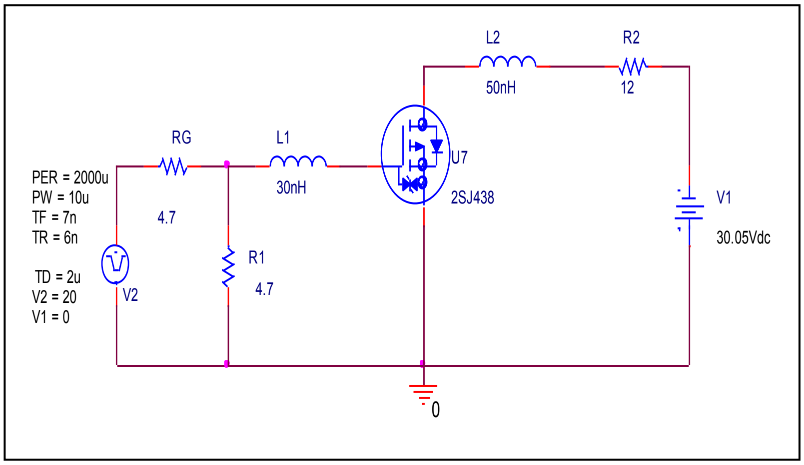
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	900.000	905.000	0.556
0.200	820.000	822.000	0.244
0.500	650.000	656.000	0.923
1.000	515.000	518.000	0.583
2.000	390.000	393.000	0.769
5.000	260.000	261.000	0.385
10.000	176.000	180.000	2.273
20.000	133.000	132.000	-0.752
50.000	90.000	87.500	-2.778

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

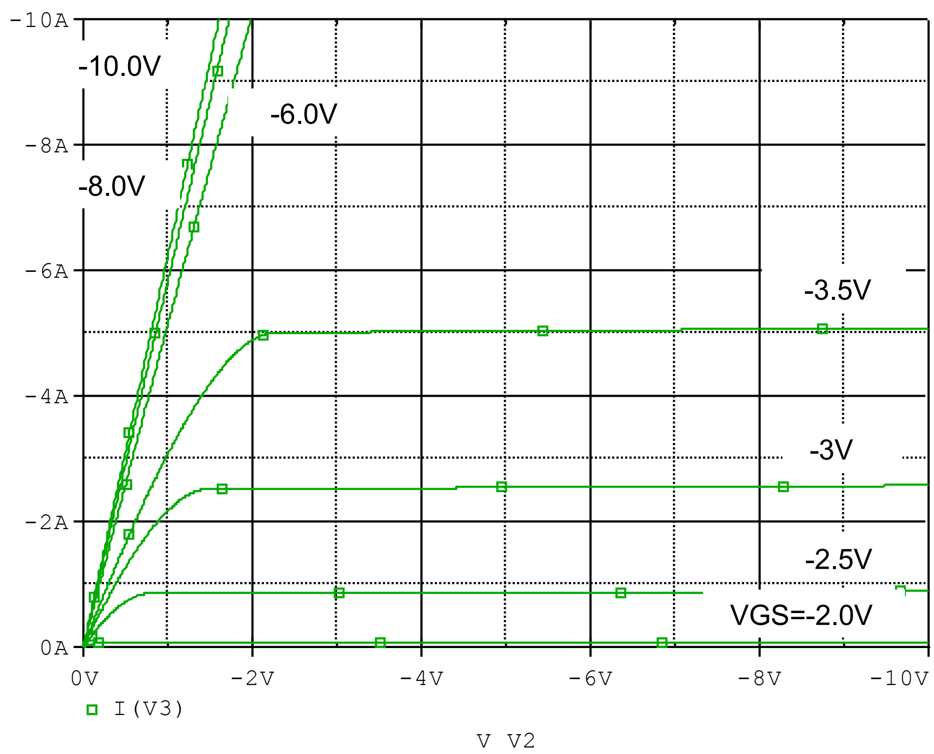


Simulation Result

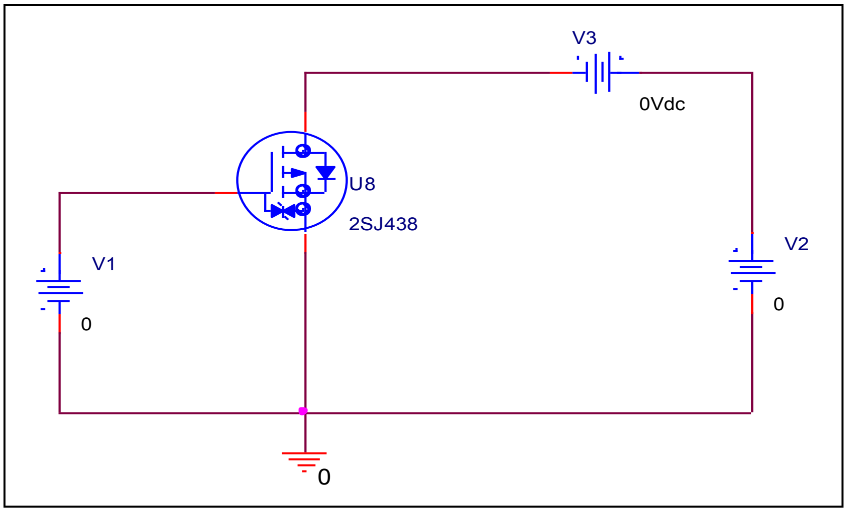
I_D=-2.5A, V_{DD}=-30V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	45.000	ns	44.904	ns	-0.213

Output Characteristic

Circuit Simulation result

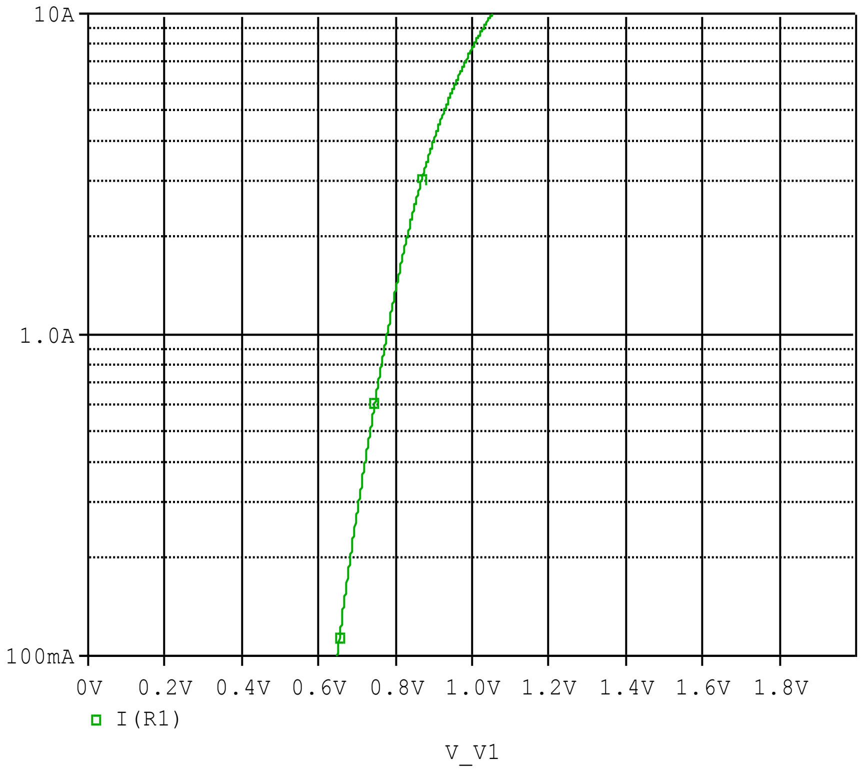


Evaluation circuit

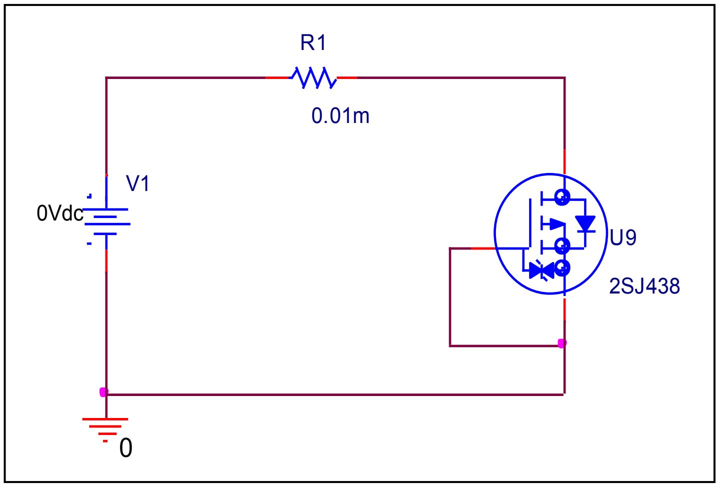


Forward Current Characteristic

Circuit Simulation Result

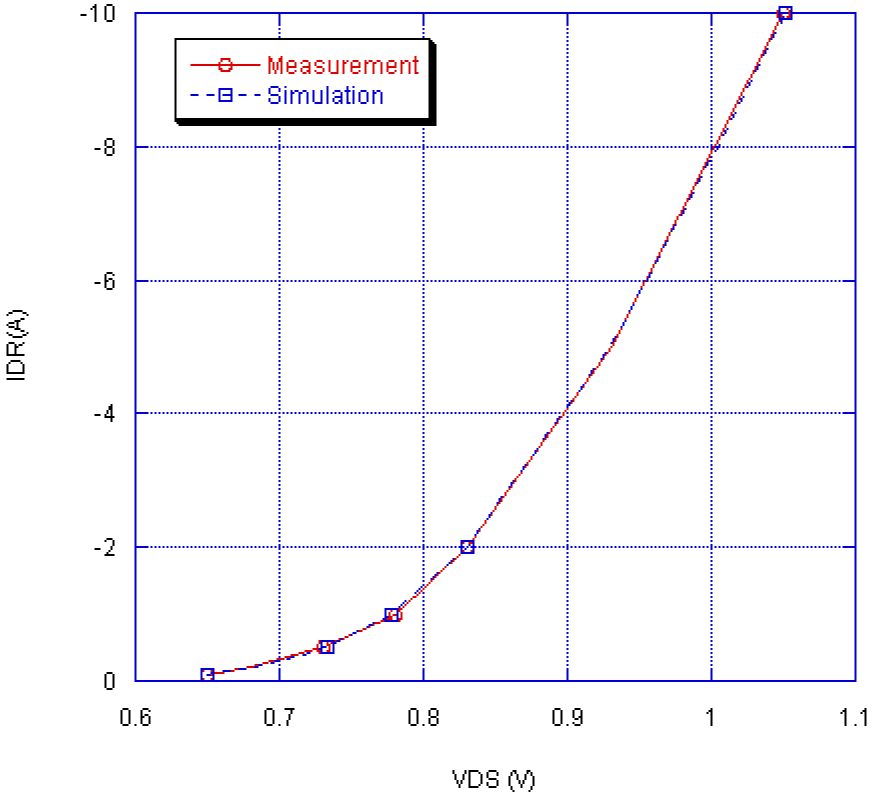


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

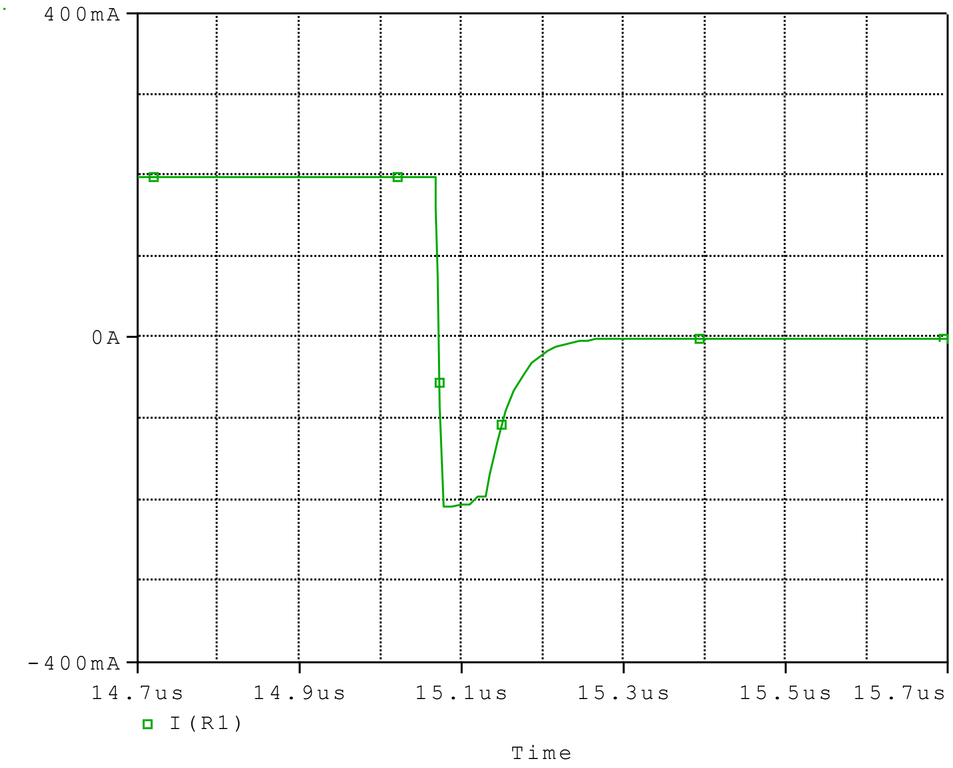


Simulation Result

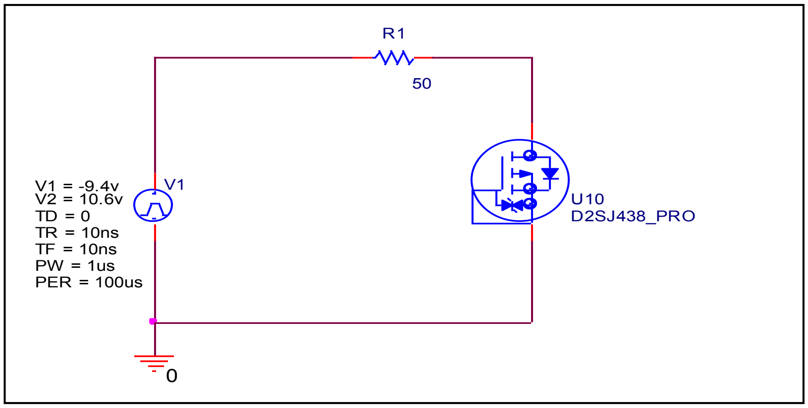
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.100	0.650	0.650	0.000
0.200	0.680	0.682	0.294
0.500	0.730	0.734	0.548
1.000	0.780	0.778	-0.256
2.000	0.830	0.830	0.000
5.000	0.930	0.929	-0.108
10.000	1.050	1.051	0.095

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

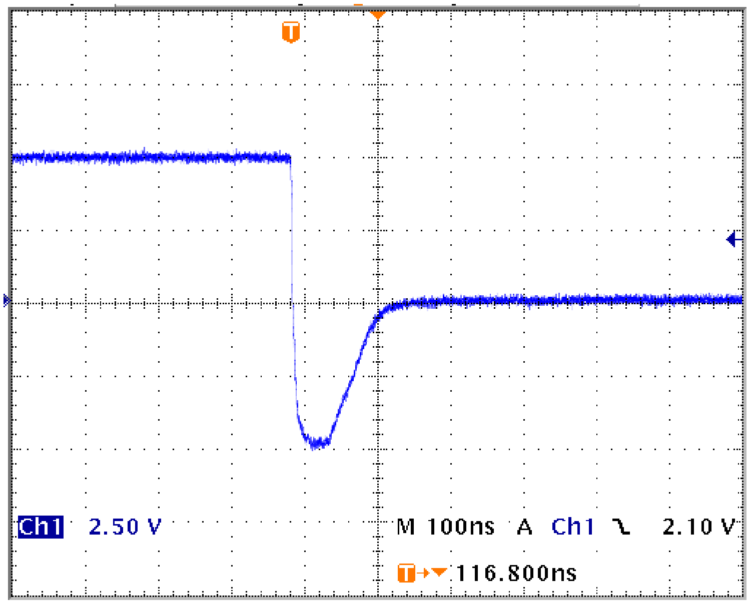


Compare Measurement vs. Simulation

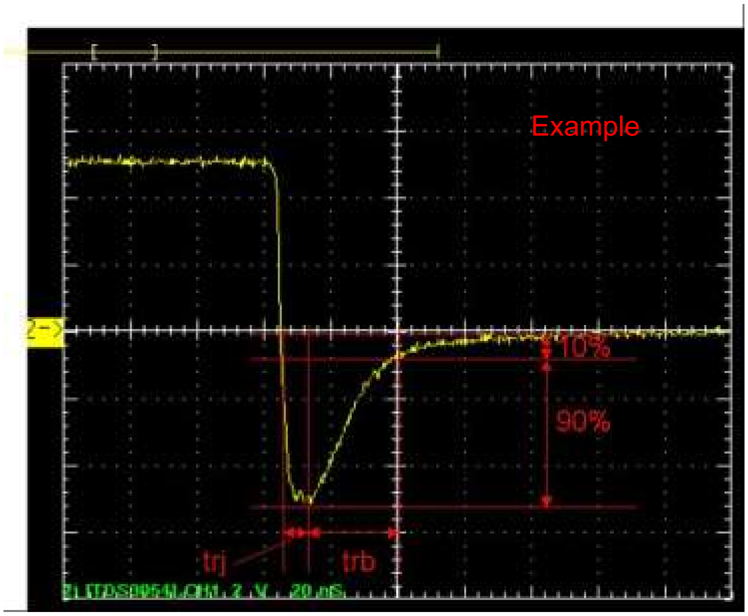
	Measurement		Simulation		Error (%)
trj	**44.000**	**ns**	**44.146**	**ns**	**0.332**
trb	**72.000**	**ns**	**72.270**	**ns**	**0.375**
trr	**116.000**	**ns**	**116.416**	**ns**	**0.359**

Reverse Recovery Characteristic

Reference



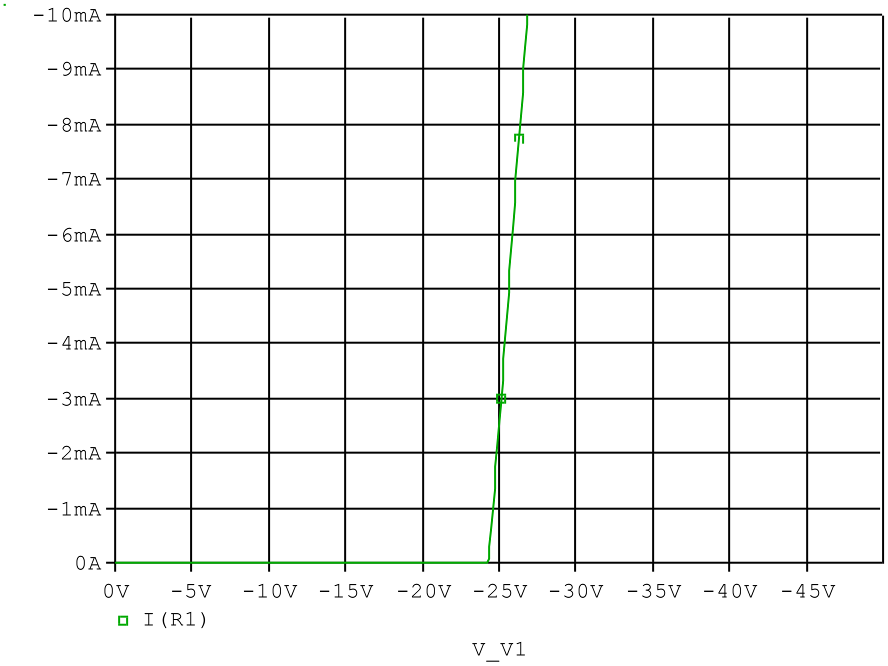
Trj=44(ns)
Trb=72(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



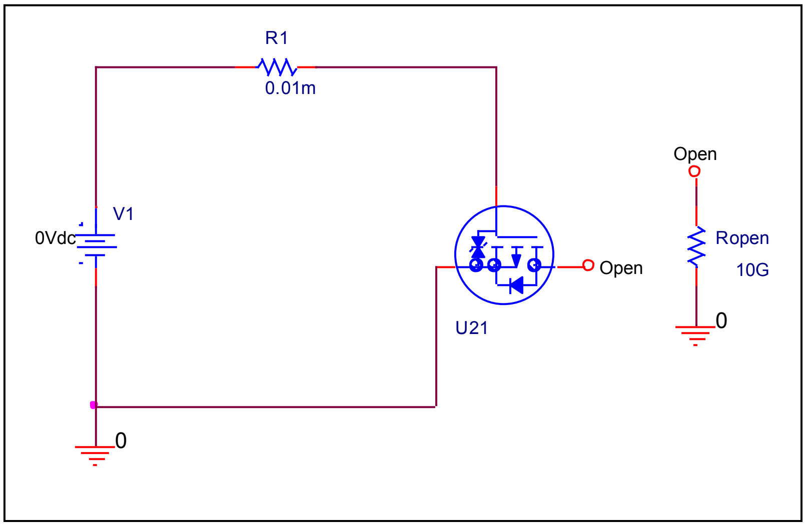
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic **Reference**