

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SJ464
MANUFACTURER: TOSHIBA
REMARK: P Channel Model
Body Diode (Professional) / ESD Protection Diode



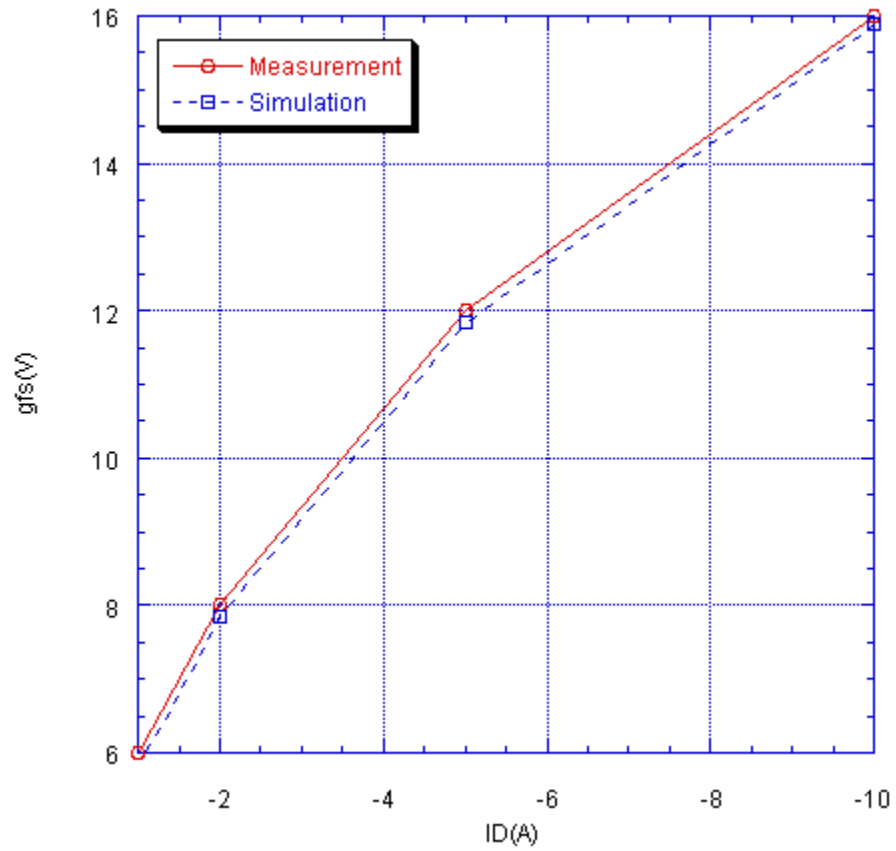
Bee Technologies Inc.

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

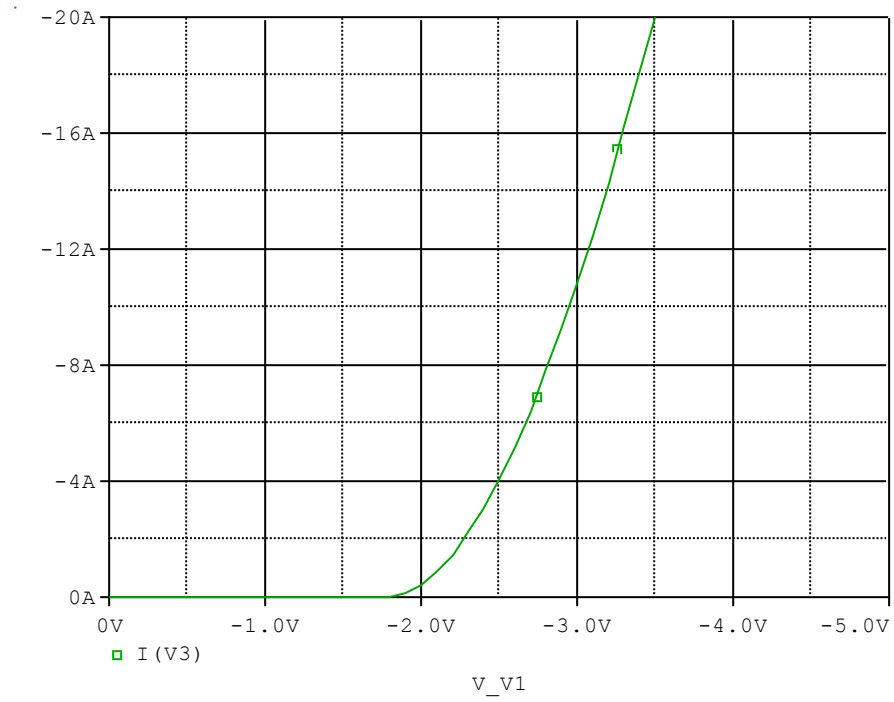


Comparison table

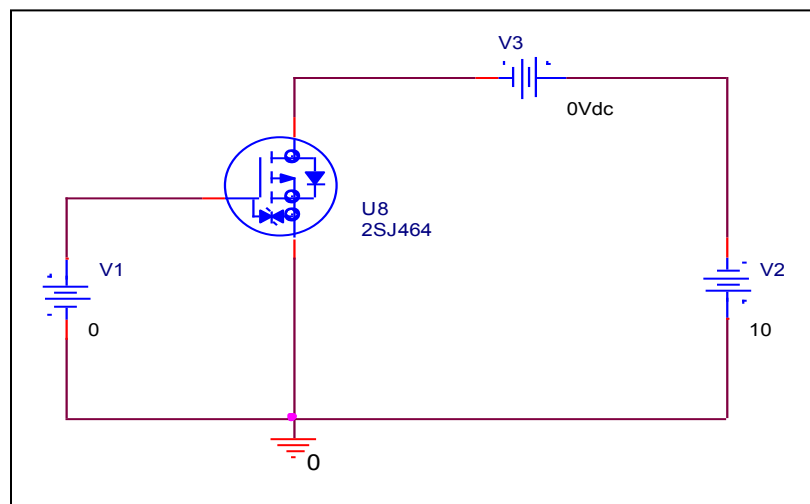
Id(A)	gfs		Error(%)
	Measurement	Simulation	
-1.000	6.000	5.750	-4.167
-2.000	8.000	7.850	-1.875
-5.000	12.000	11.700	-2.500
-10.000	16.000	15.800	-1.250

V_{gs}-I_d Characteristic

Circuit Simulation result

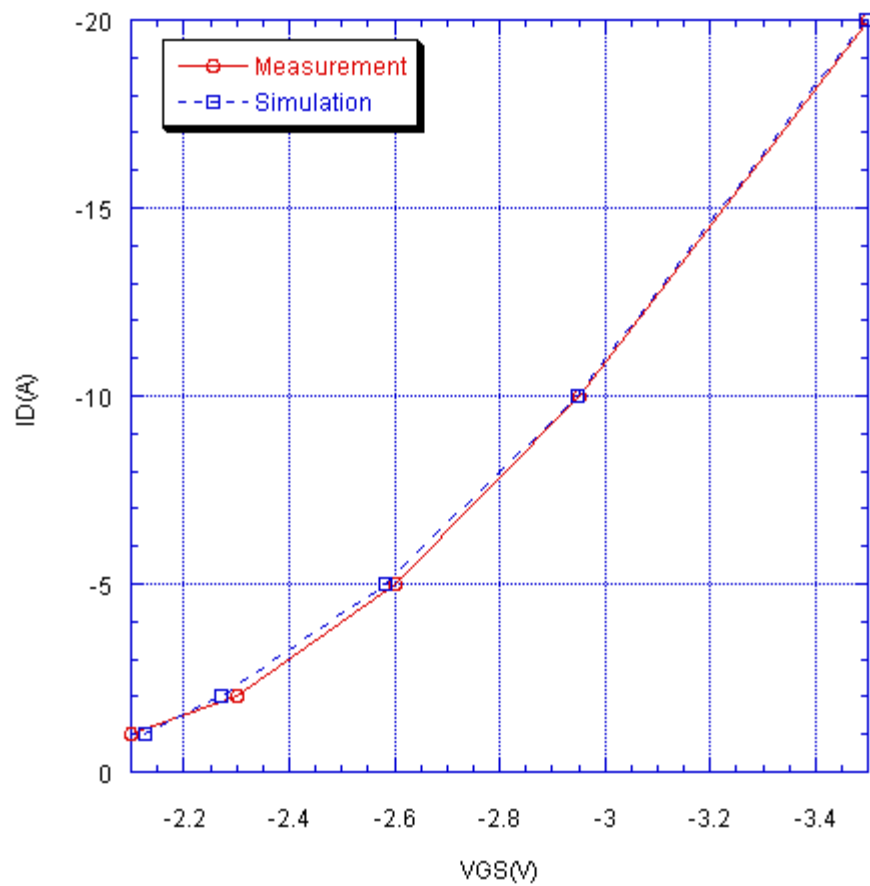


Evaluation circuit



Comparison Graph

Circuit Simulation Result

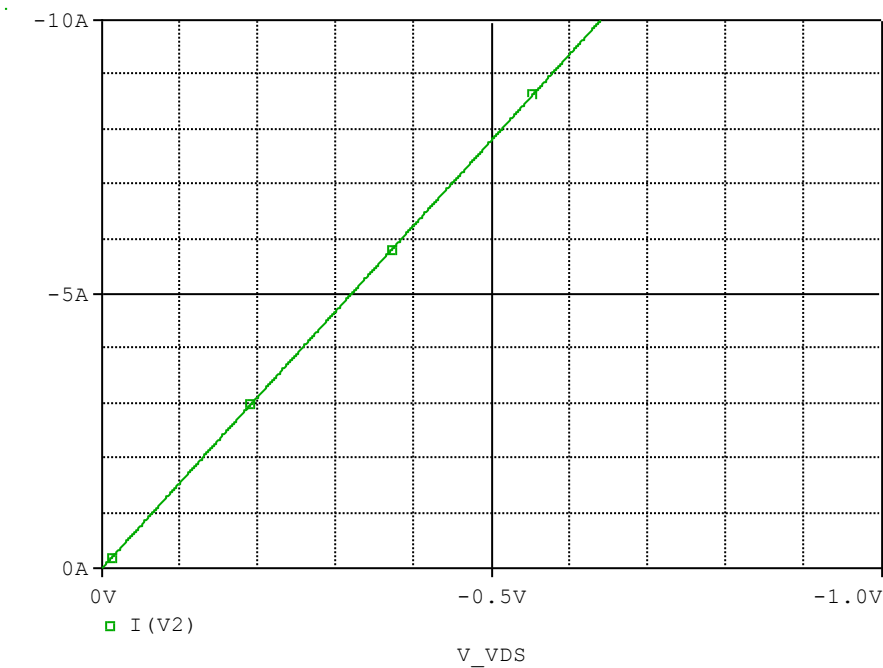


Simulation Result

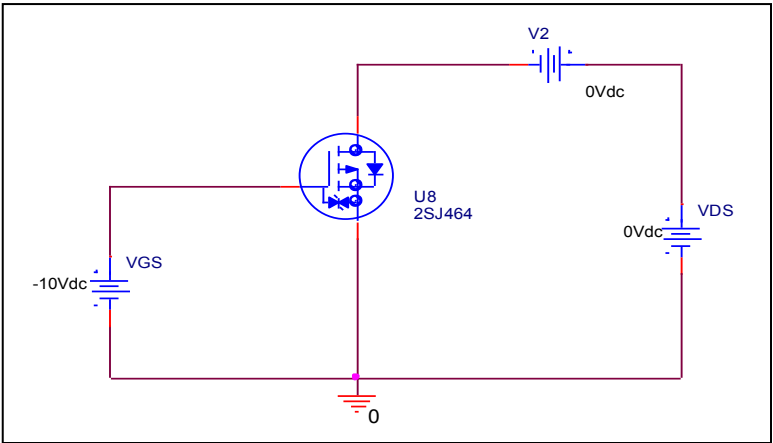
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
-1.000	-2.100	-2.125	1.190
-2.000	-2.300	-2.272	-1.217
-5.000	-2.600	-2.582	-0.692
-10.000	-2.950	-2.949	-0.034
-20.000	-3.500	-3.494	-0.171

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

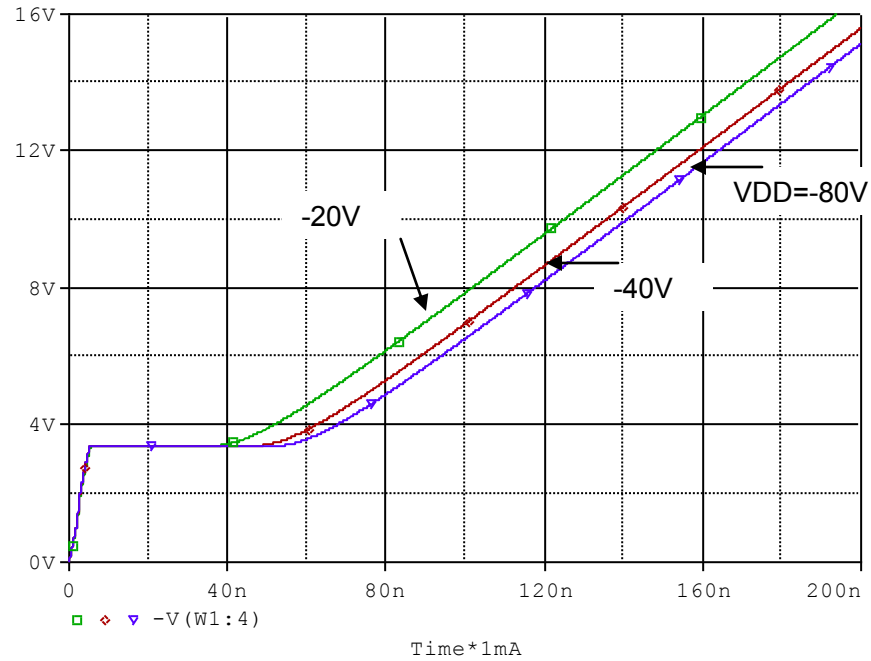


Simulation Result

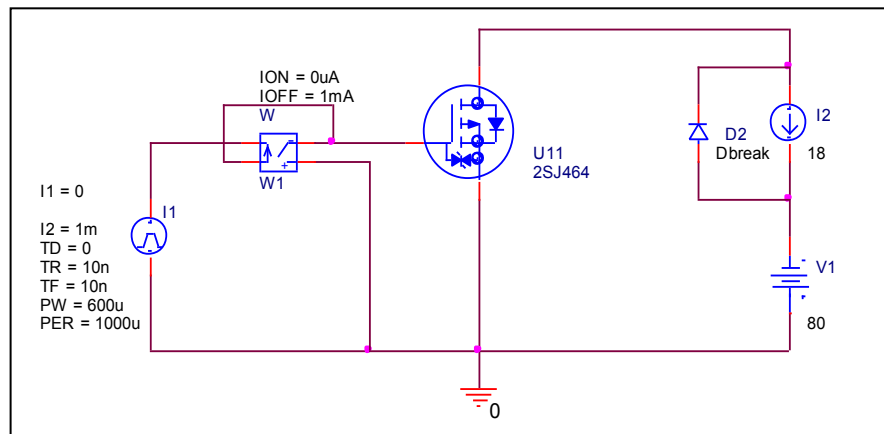
$I_D = -9A, V_{GS} = -10V$	Measurement		Simulation		Error (%)
$R_{DS(on)}$	64.000	mΩ	64.000	mΩ	0.000

Gate Charge Characteristic

Circuit Simulation result



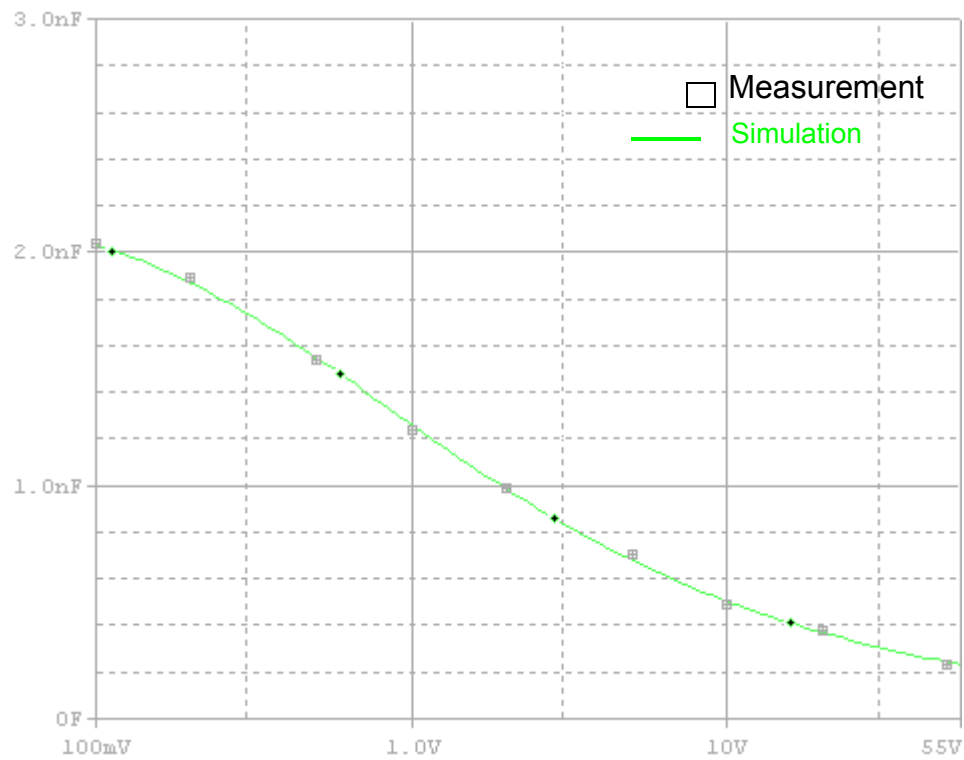
Evaluation circuit



Simulation Result

$V_{DD}=-80V, I_D=-18A$ $, V_{GS}=-10V$	Measurement		Simulation		Error (%)
Qgs	5.000	nC	5.034	nC	0.680
Qgd	50.000	nC	49.910	nC	-0.180
Qg	140.000	nC	140.659	nC	0.471

Capacitance Characteristic

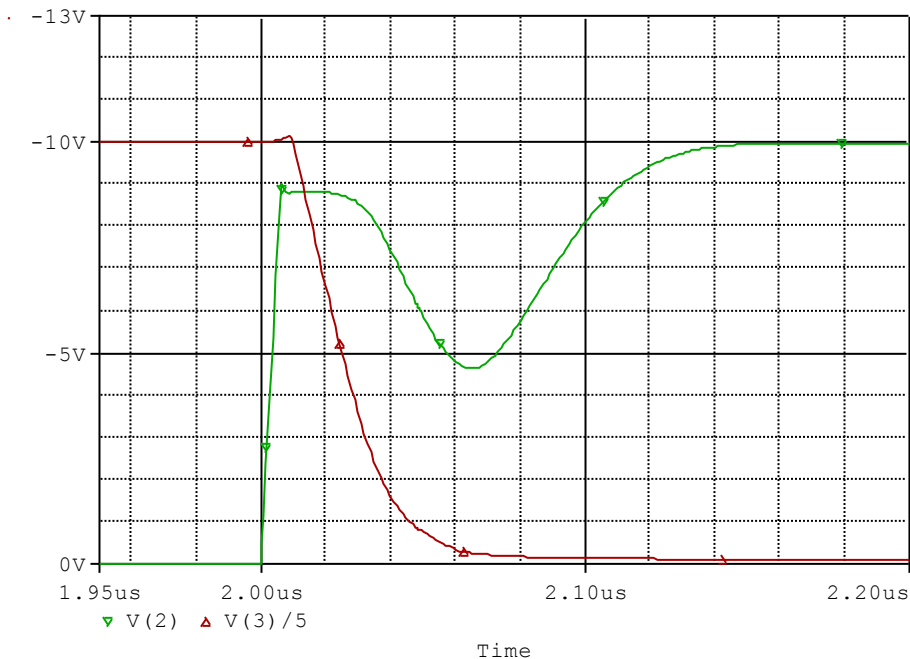


Simulation Result

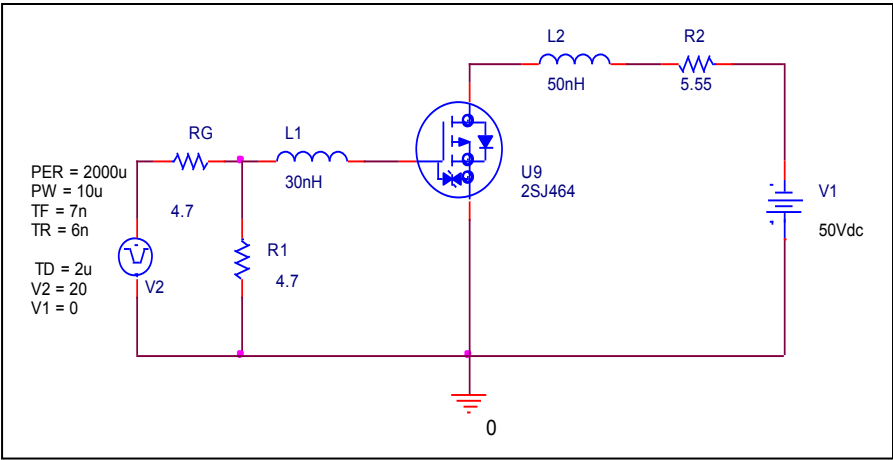
V _{DS} (V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	2.050	2.056	0.293
0.200	1.900	1.895	-0.263
0.500	1.550	1.551	0.065
1.000	1.250	1.252	0.160
2.000	1.000	0.997	-0.300
5.000	0.710	0.704	-0.845
10.000	0.500	0.503	0.600
20.000	0.390	0.388	-0.513
50.000	0.240	0.245	2.083

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

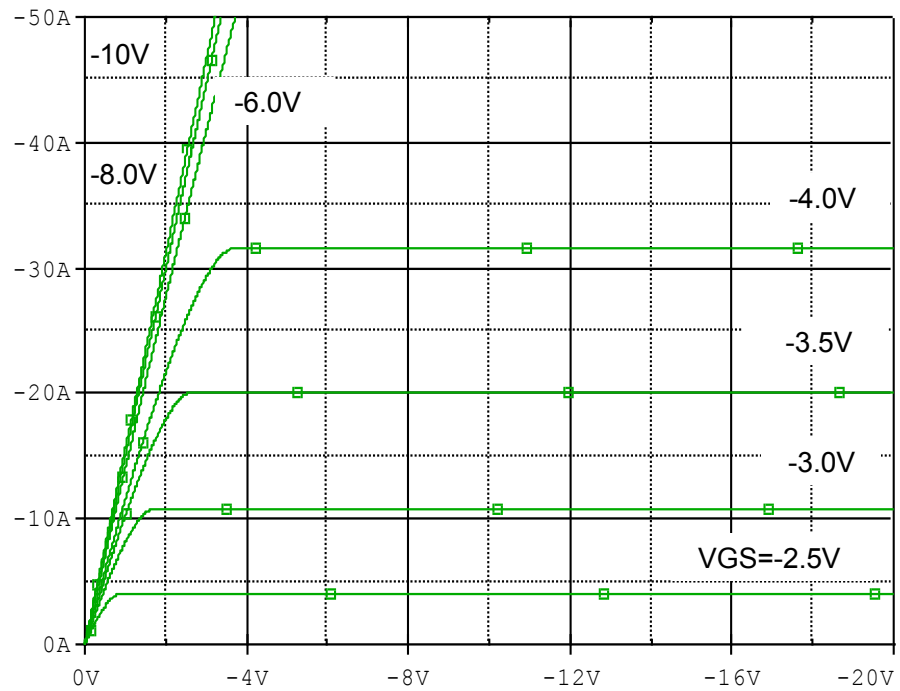


Simulation Result

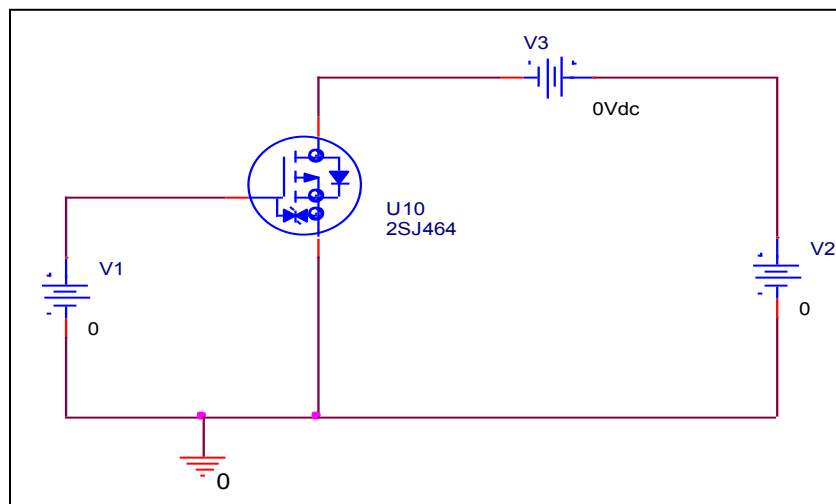
$I_D = -9A$, $V_{DD} = -80V$ $V_{GS} = 0/10V$	Measurement		Simulation		Error(%)
	ton	45.000 ns	44.937 ns	ns	
					-0.140

Output Characteristic

Circuit Simulation result

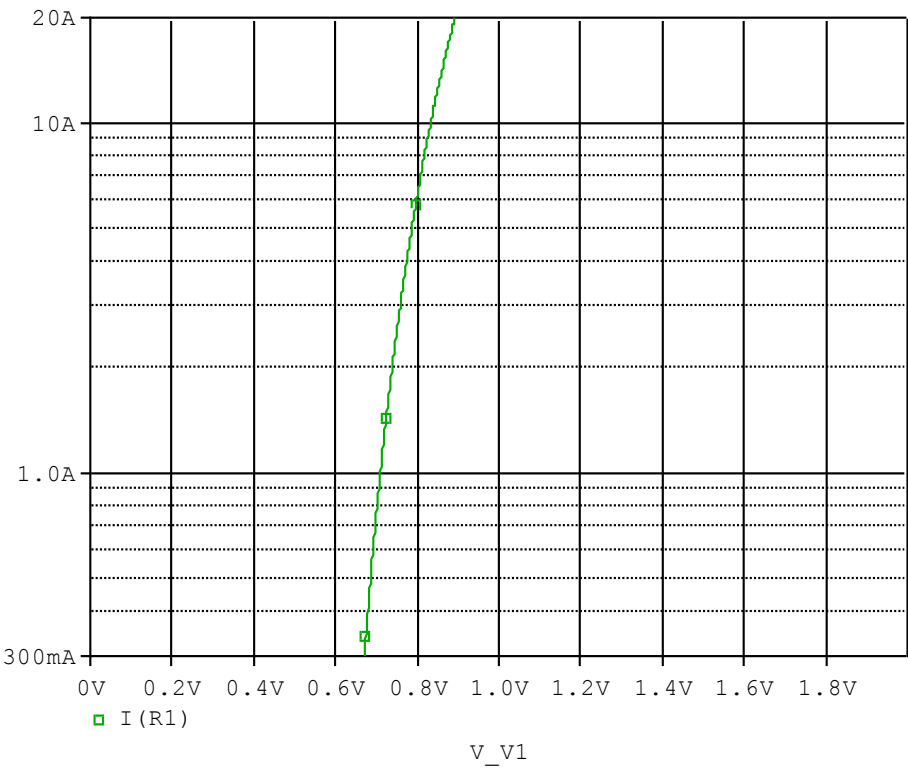


Evaluation circuit

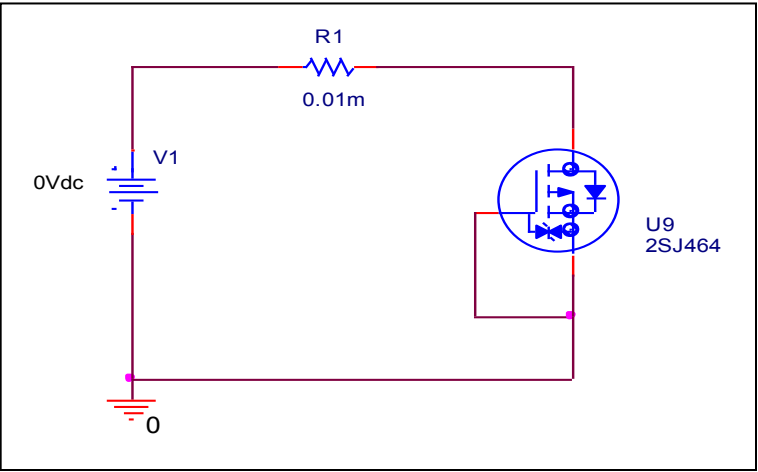


Forward Current Characteristic

Circuit Simulation Result

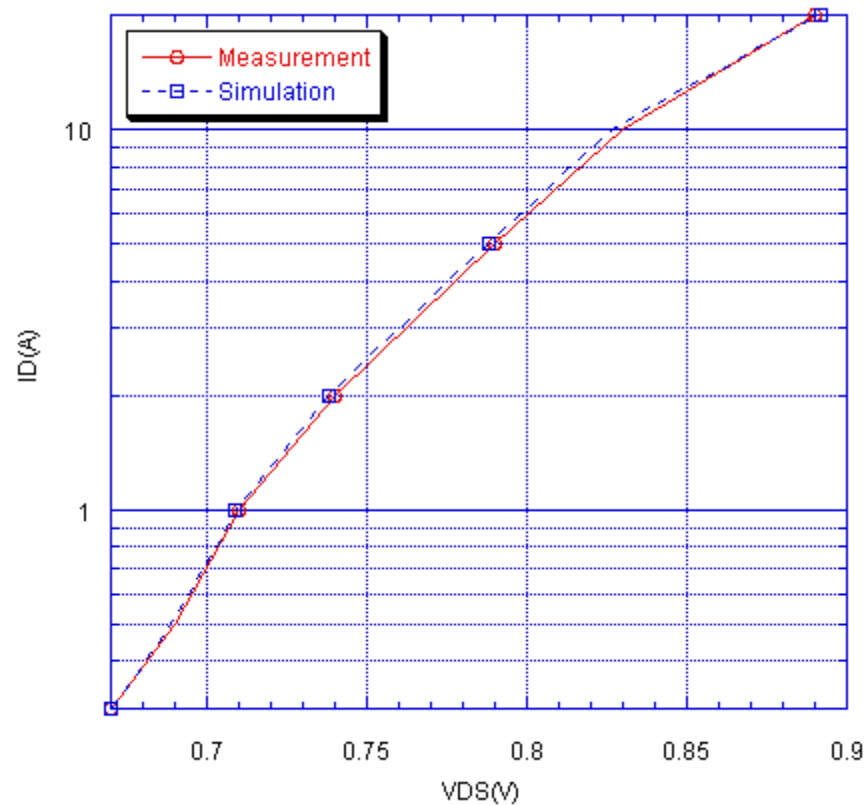


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

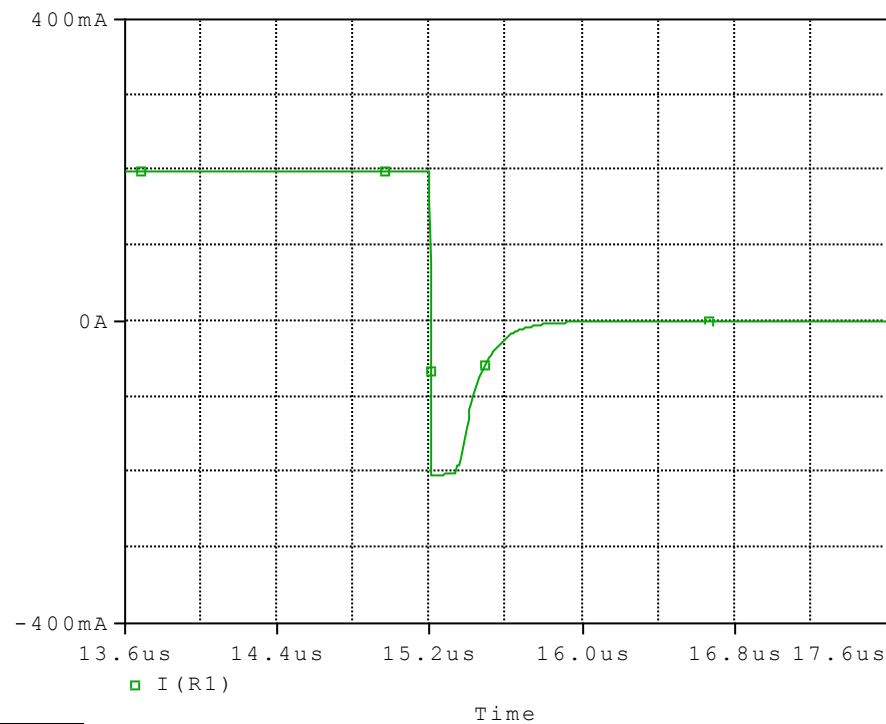


Simulation Result

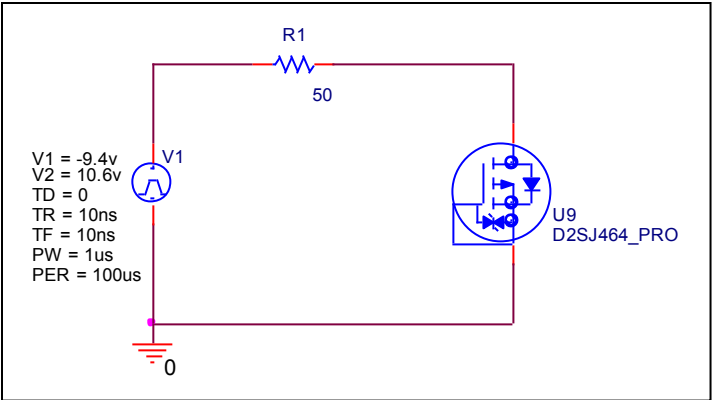
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.300	0.670	0.670	0.000
0.500	0.690	0.689	-0.145
1.000	0.710	0.709	-0.141
2.000	0.740	0.738	-0.270
5.000	0.790	0.788	-0.253
10.000	0.830	0.827	-0.361
20.000	0.890	0.892	0.225

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

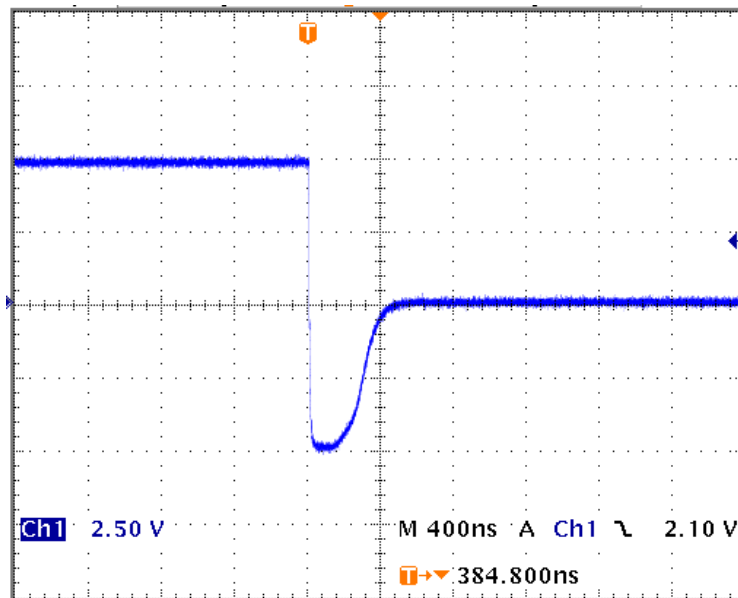


Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	128.000	ns	126.651	ns	-1.054
trb	256.000	ns	256.410	ns	0.160
trr	384.000	ns	383.061	ns	-0.245

Reverse Recovery Characteristic

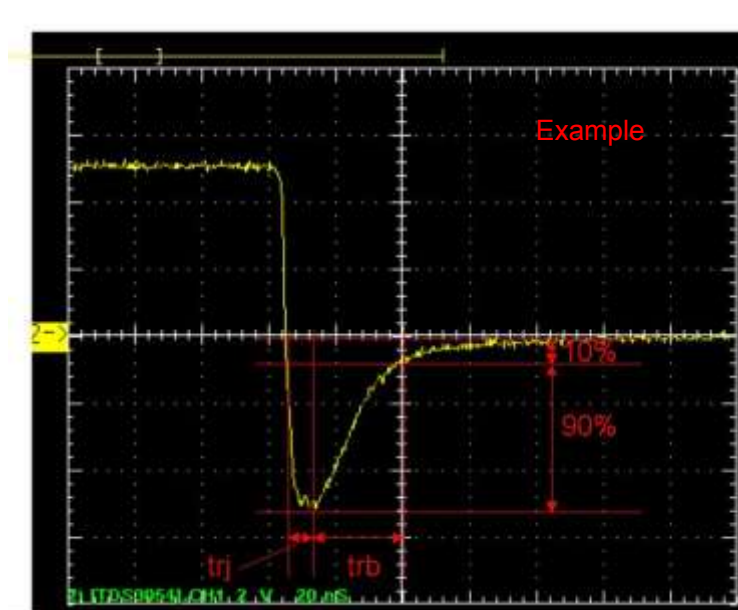
Reference



Trj=128(ns)

Trb=256(ns)

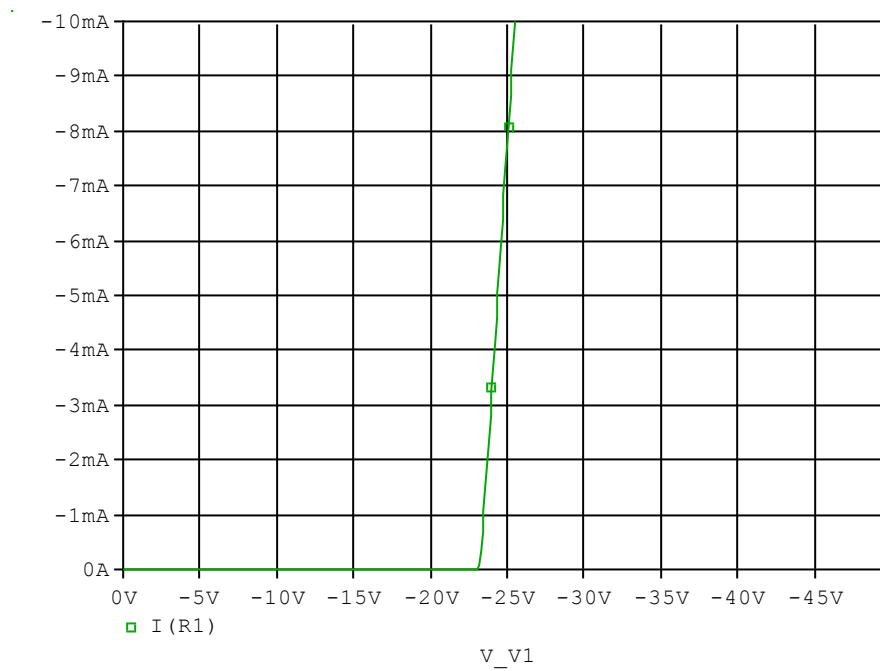
Conditions: $I_{fwd} = I_{rev} = 0.2(A)$, $R_I = 50$



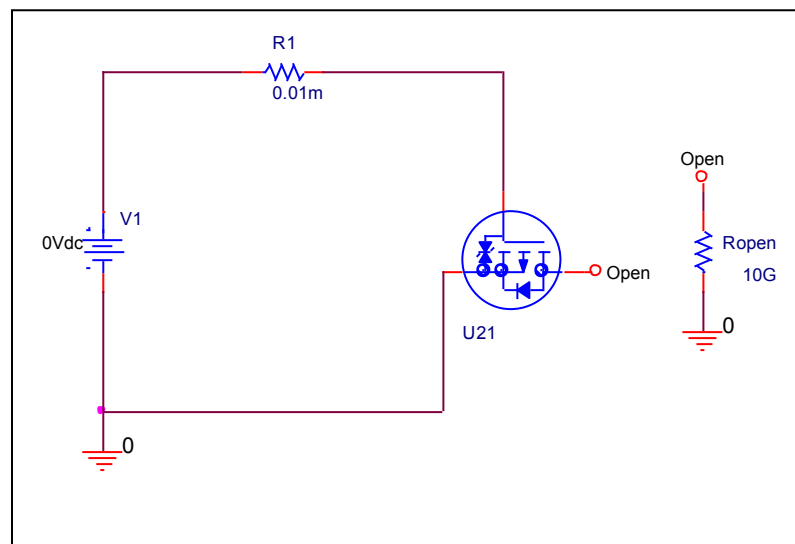
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic

Reference

