Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameters)
PART NUMBER: 2SK2718
MANUFACTURER: TOSHIBA
Body Diode (Model Parameters) / ESD Protection Diode

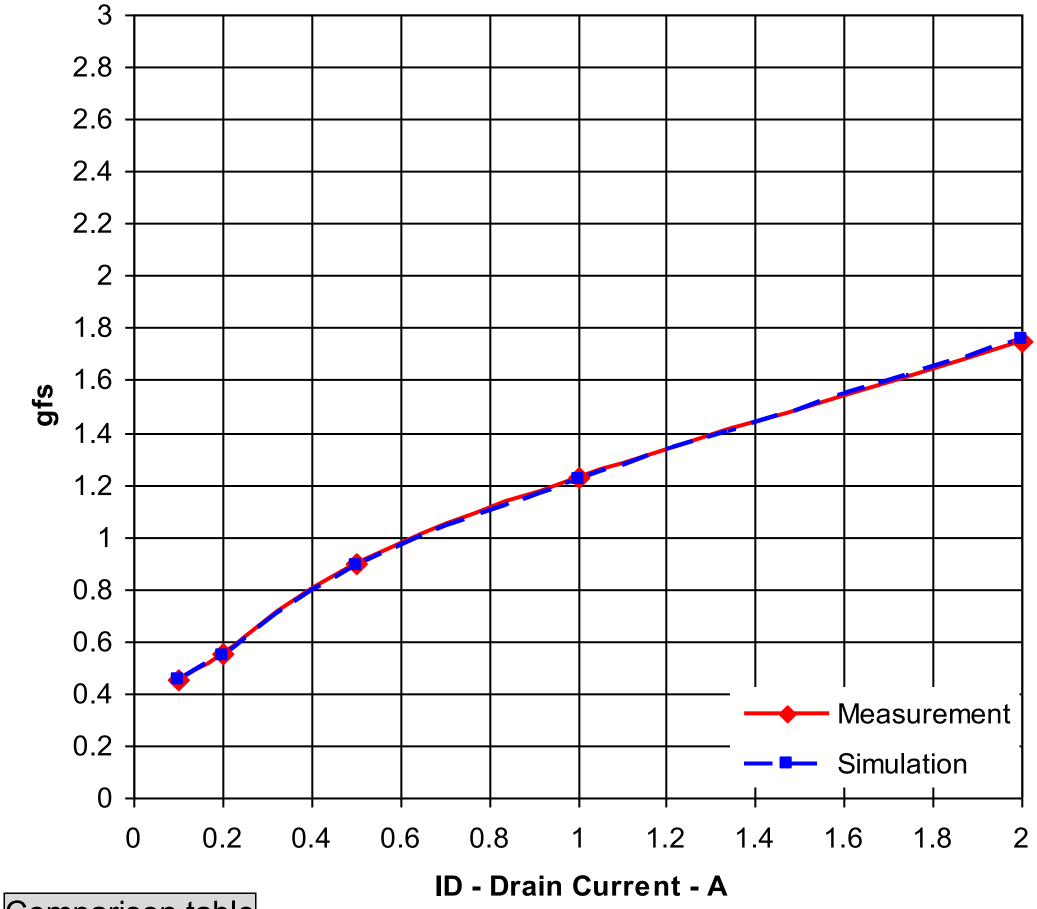
Bee Technologies Inc.

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	Mobility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Transconductance Characteristic

Circuit Simulation Result

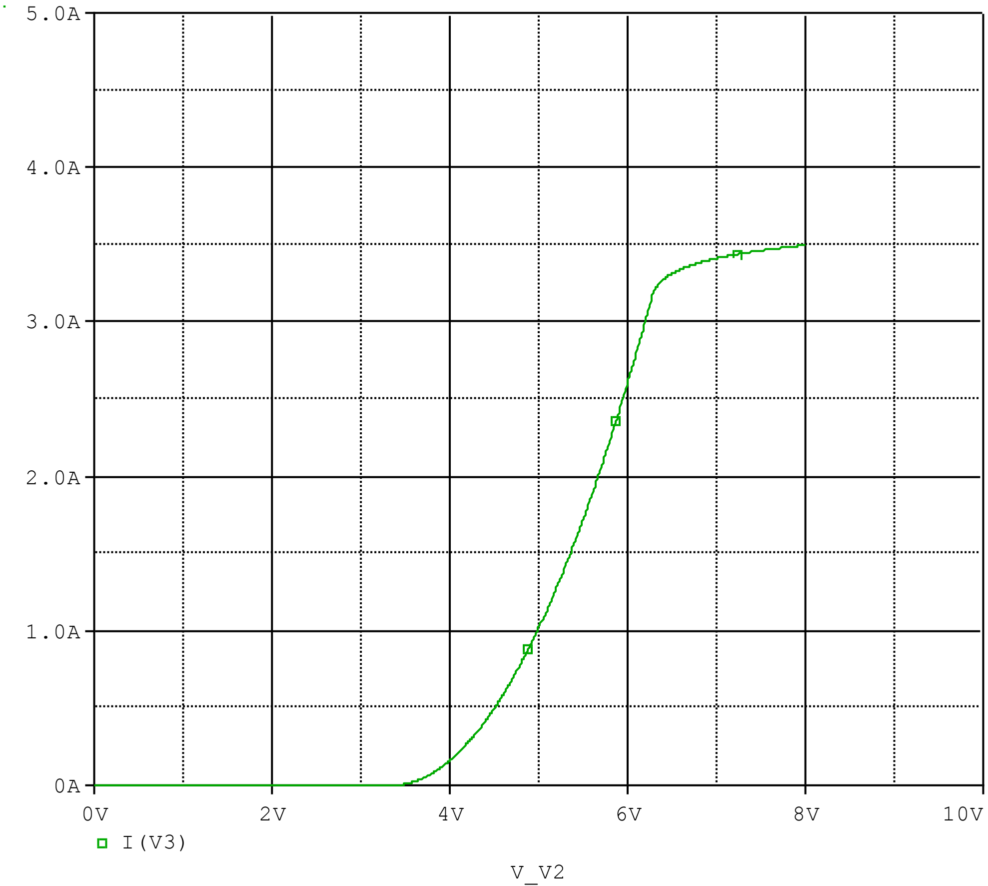


Comparison table

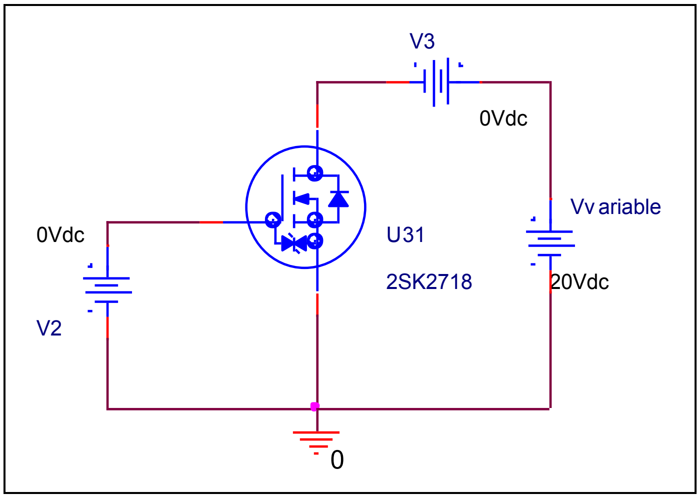
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	0.450	0.456	1.333
0.2	0.550	0.541	-1.636
0.5	0.900	0.893	-0.778
1	1.230	1.220	-0.813
2	1.750	1.754	0.229

Vgs-Id Characteristic

Circuit Simulation result

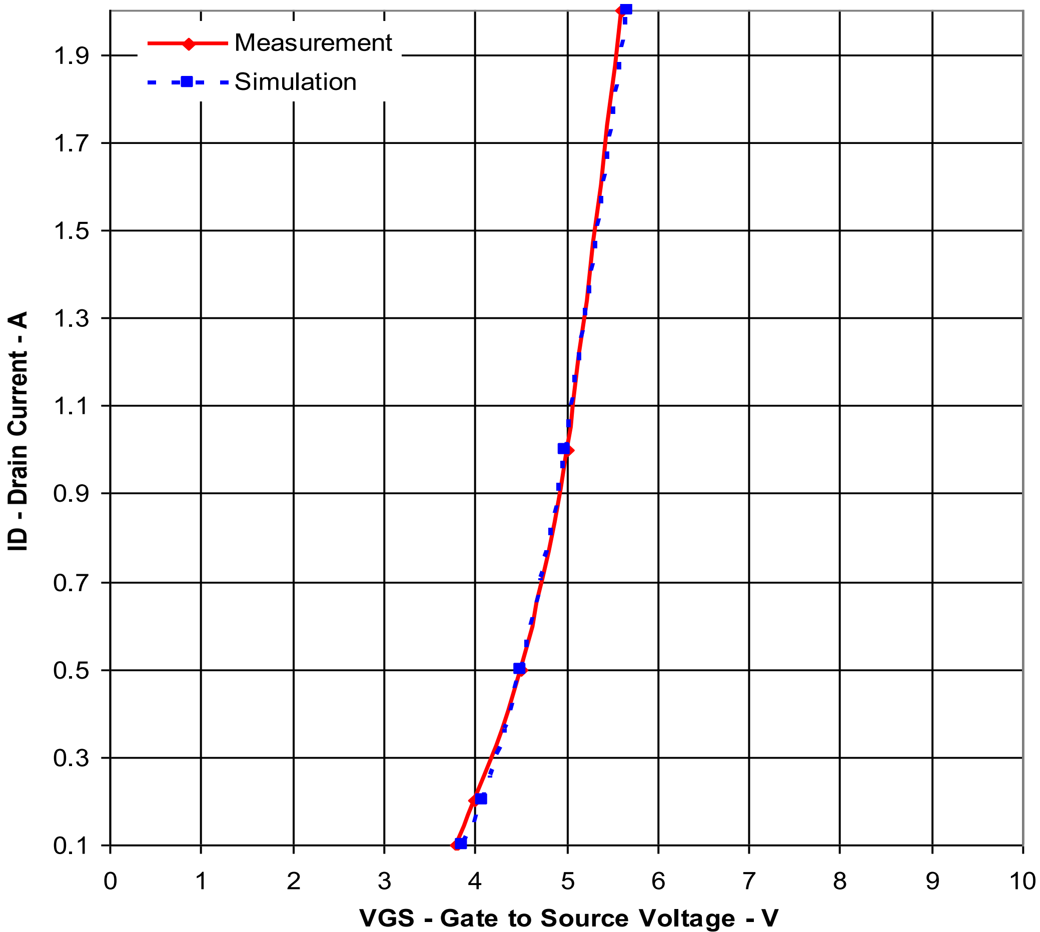


Evaluation circuit



Comparison Graph

Circuit Simulation Result

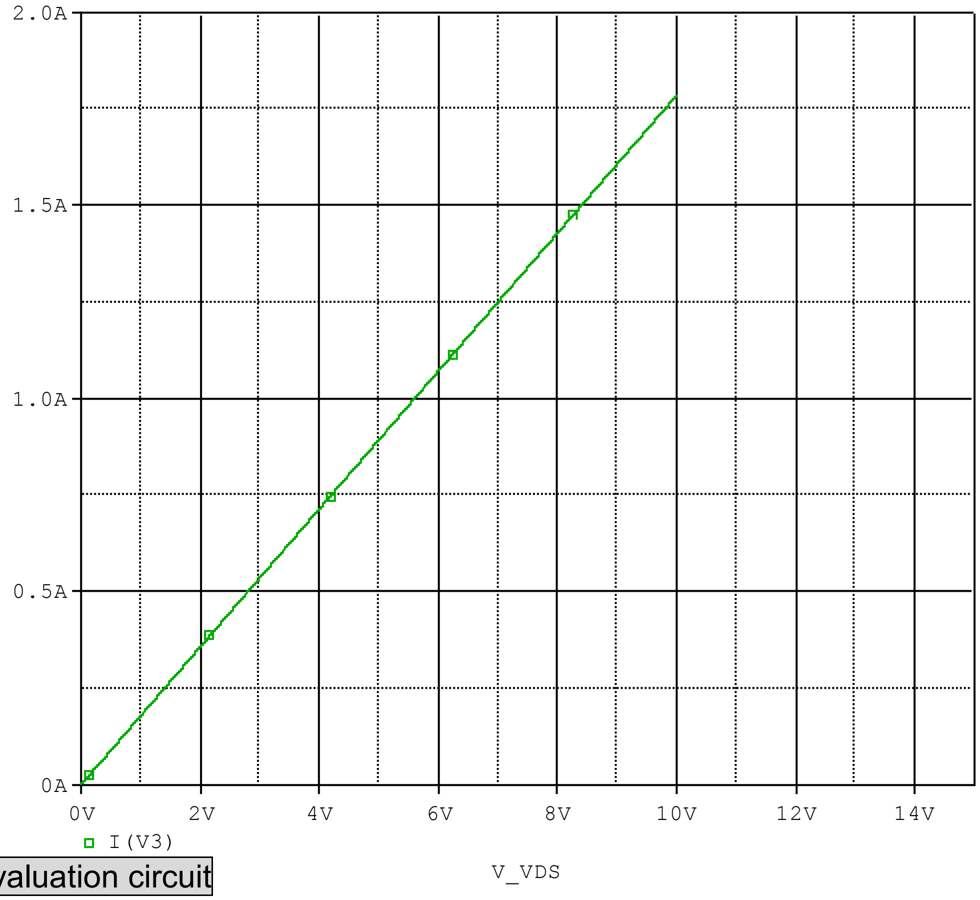


Simulation Result

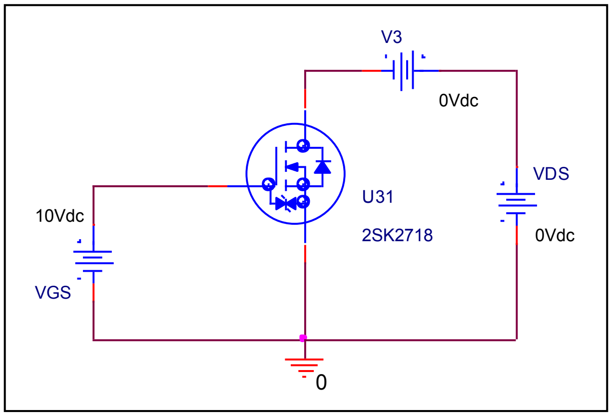
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.1	3.800	3.867	1.763
0.2	4.000	4.078	1.950
0.5	4.500	4.503	0.067
1	5.000	4.982	-0.360
2	5.600	5.669	1.232

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

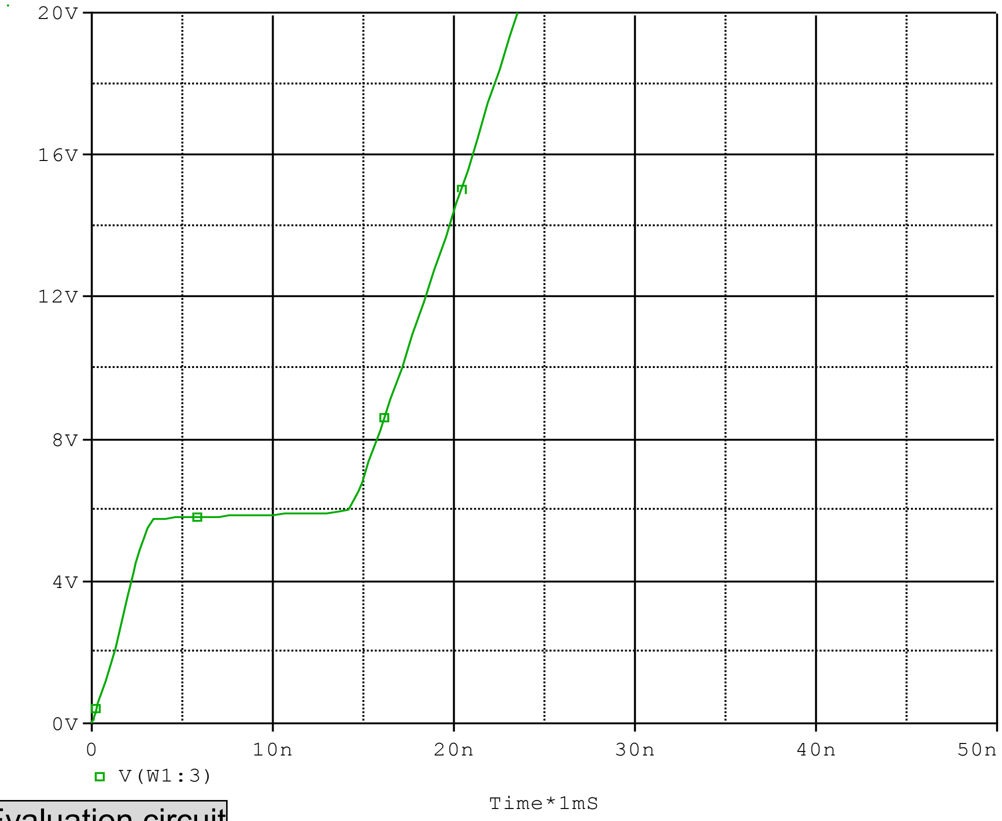


Simulation Result

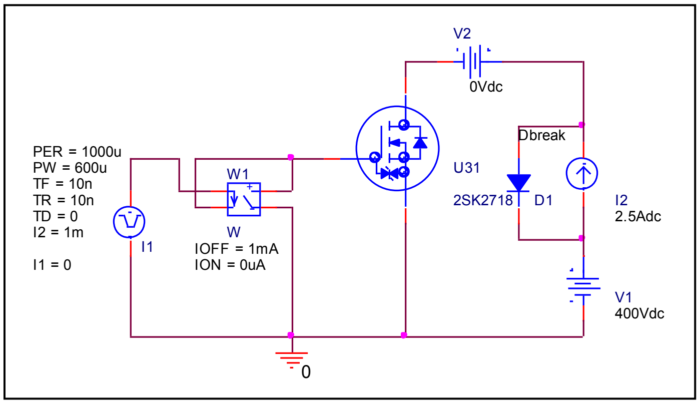
I_D=1.5A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	5.600	Ω	5.600	Ω	0

Gate Charge Characteristic

Circuit Simulation result



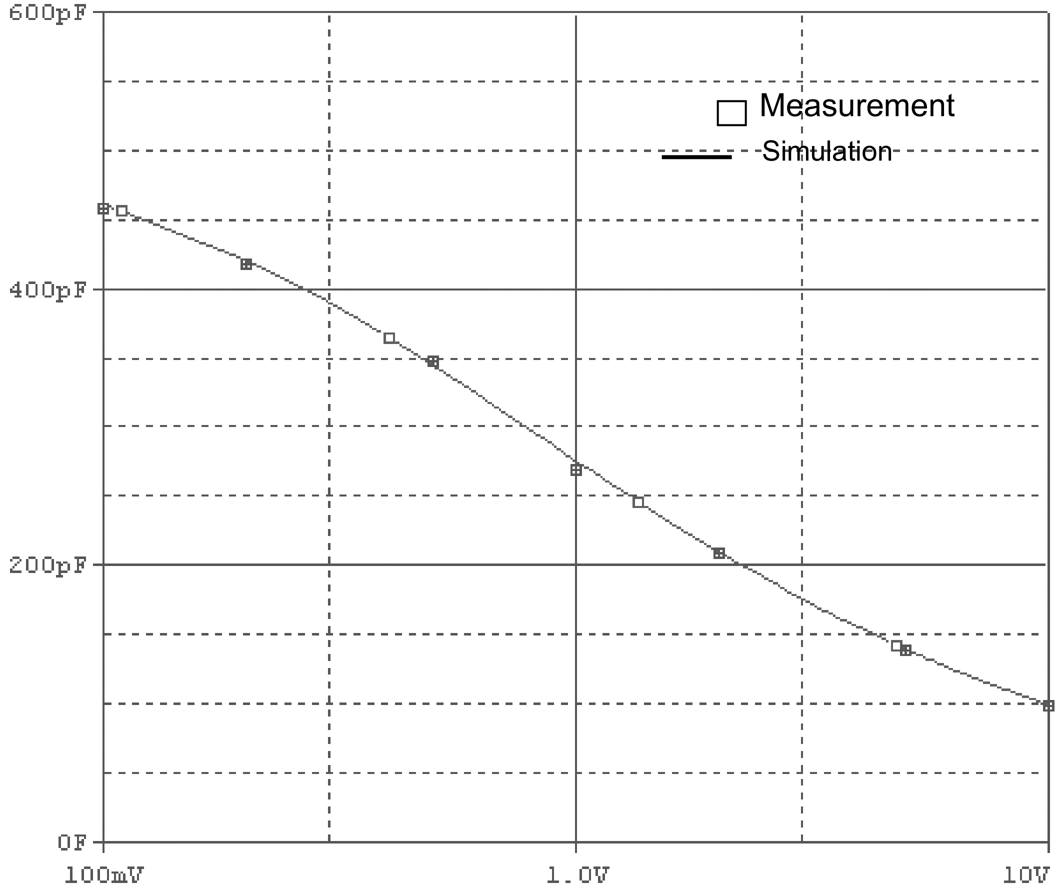
Evaluation circuit



Simulation Result

V_{DD}=400V,I_D=2.5A ,V_{GS}=10V	Measurement	Simulation	Error (%)
Qgs(nC)	3.000	2.978	-0.733
Qgd(nC)	11.000	11.126	1.145
Qg	21.000	17.111	-18.519

Capacitance Characteristic

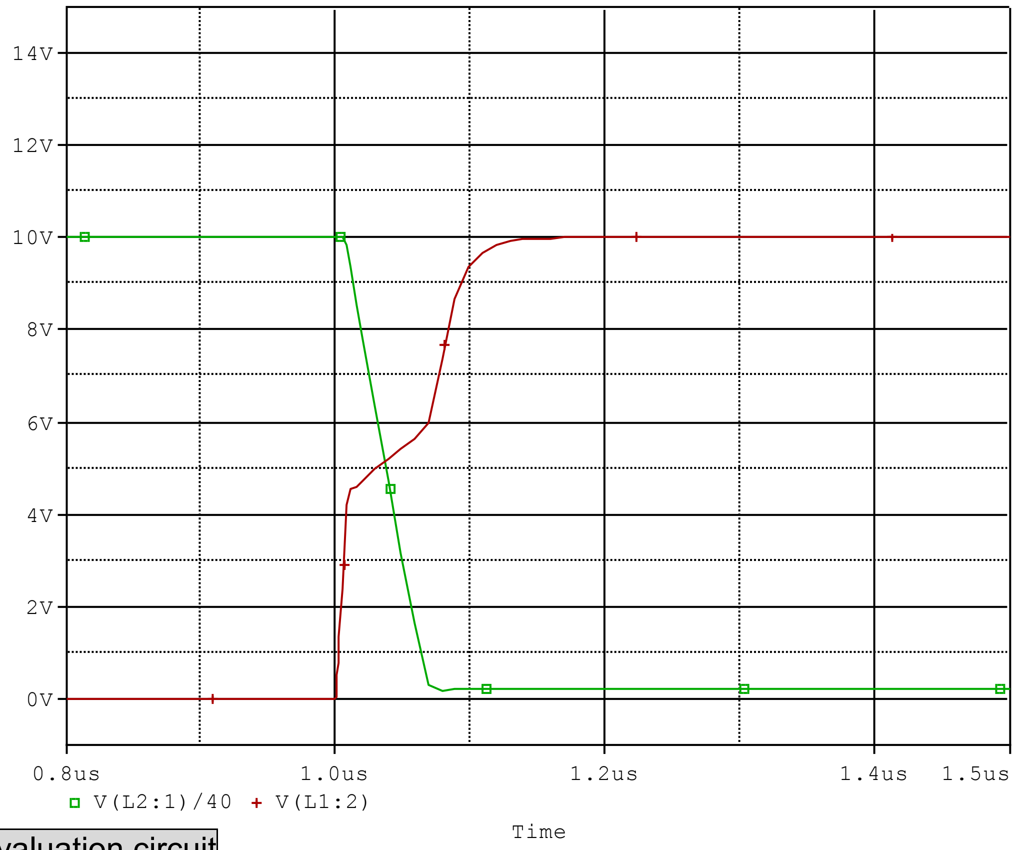


Simulation Result

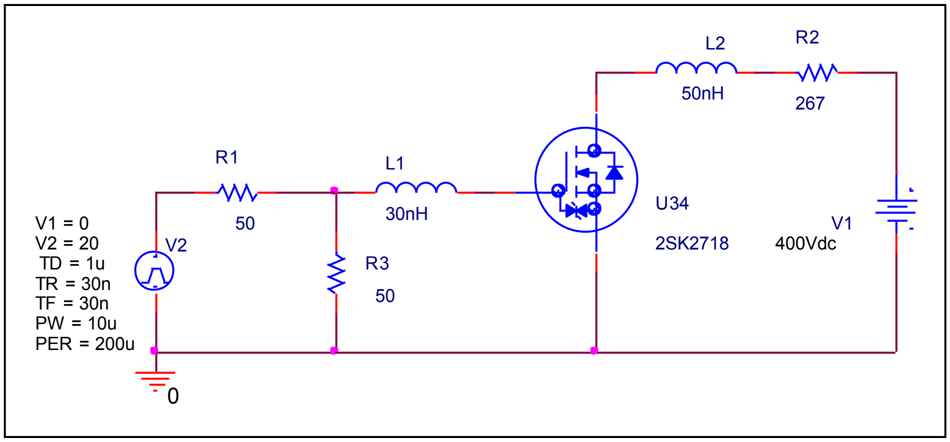
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	460.000	460.000	0.000
0.2	420.000	422.000	0.476
0.5	350.000	349.000	-0.286
1	270.000	273.000	1.111
2	210.000	210.000	0.000
5	140.000	140.000	0.000
10	100.000	100.000	0.000

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

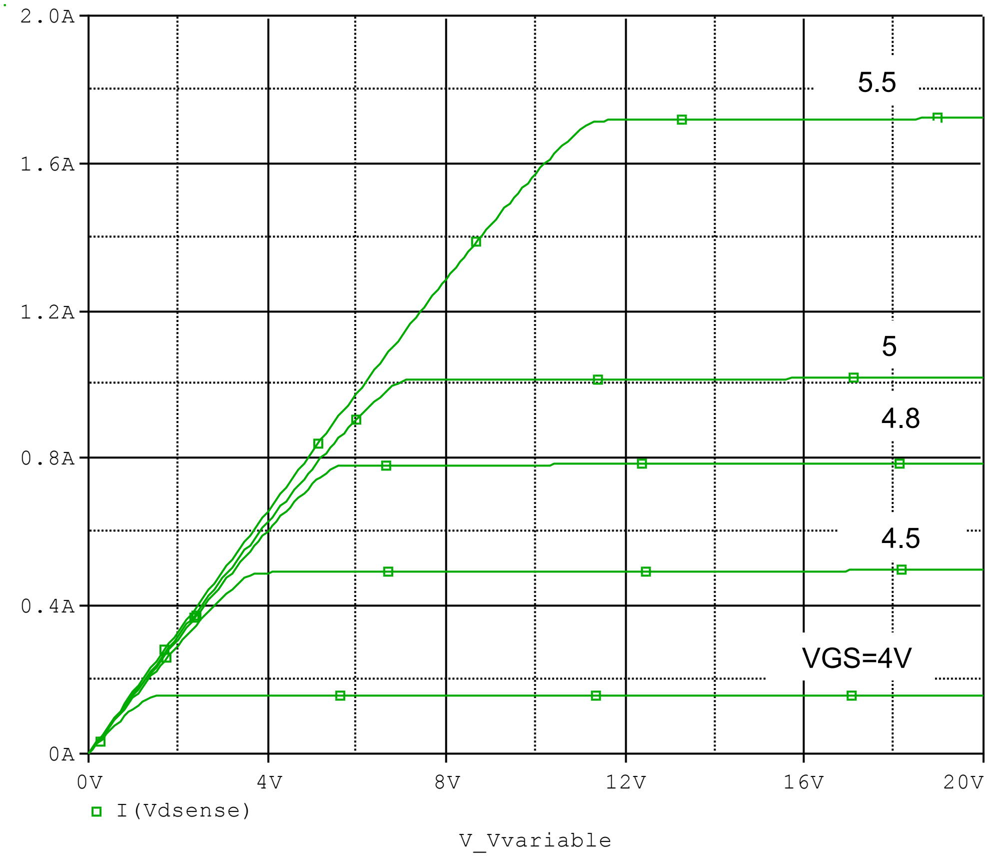


Simulation Result

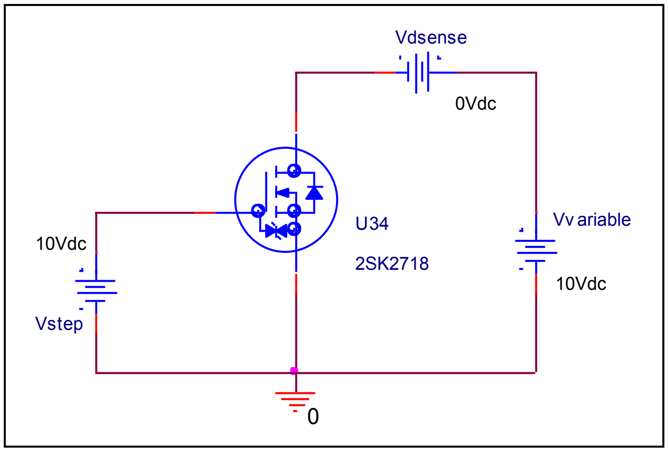
I_D=1.5A, V_{DD}=400V V_{GS}=0/10V	Measurement	Simulation	Error(%)
Ton(ns)	60.000	61.650	2.750

Output Characteristic

Circuit Simulation result

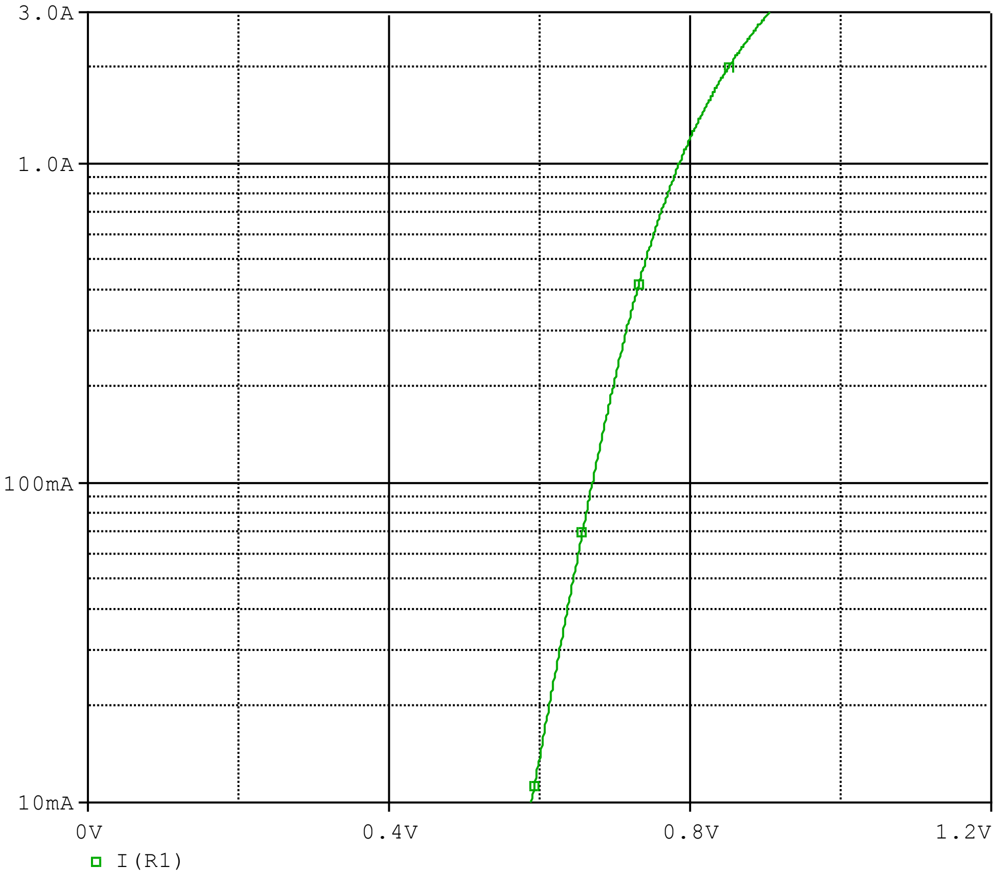


Evaluation circuit

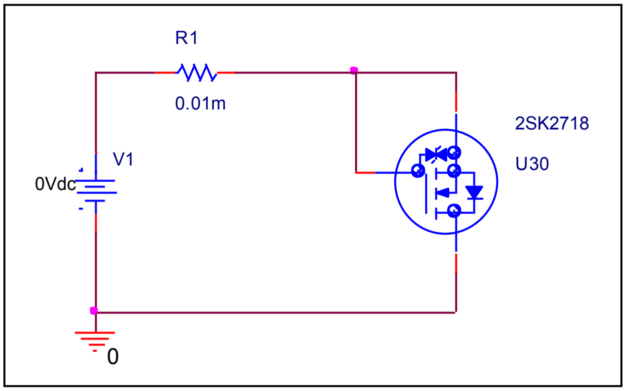


BODY DIODE
Forward Current Characteristic

Circuit Simulation Result

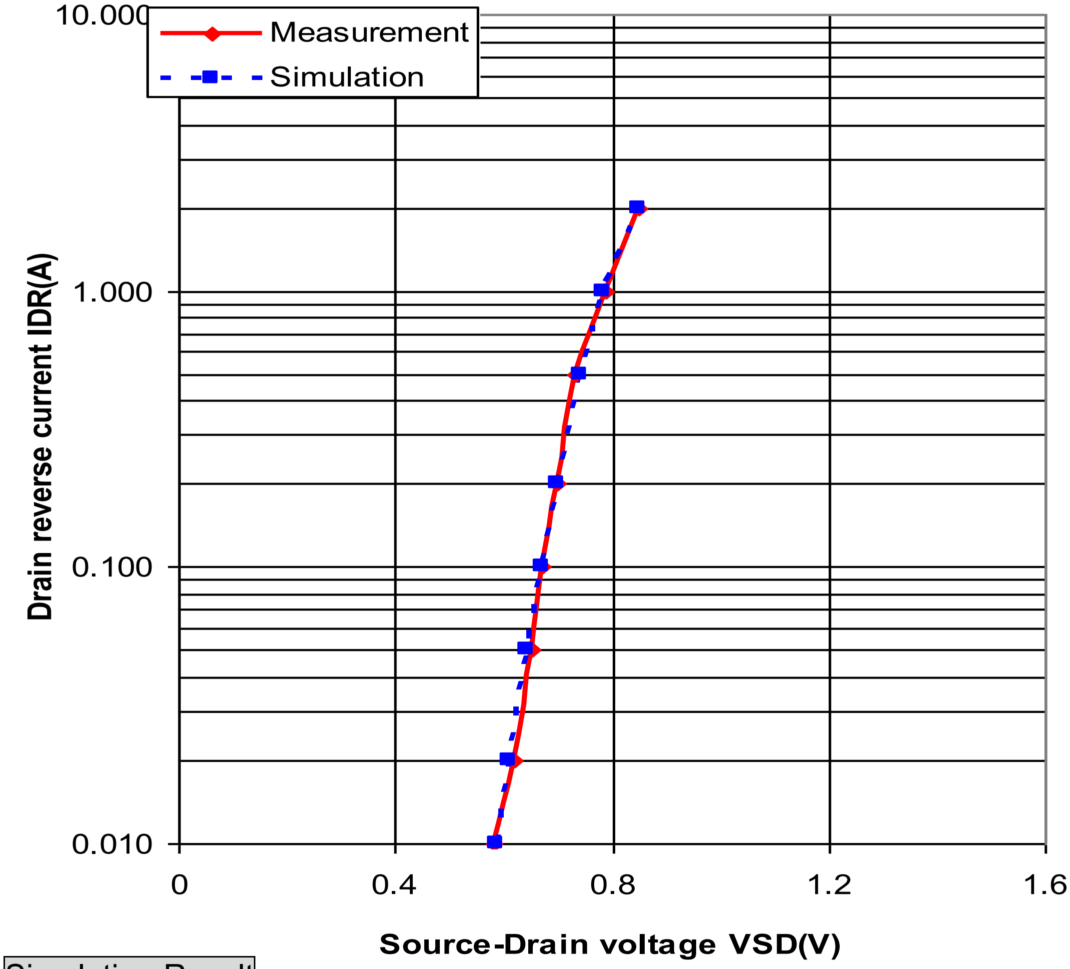


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

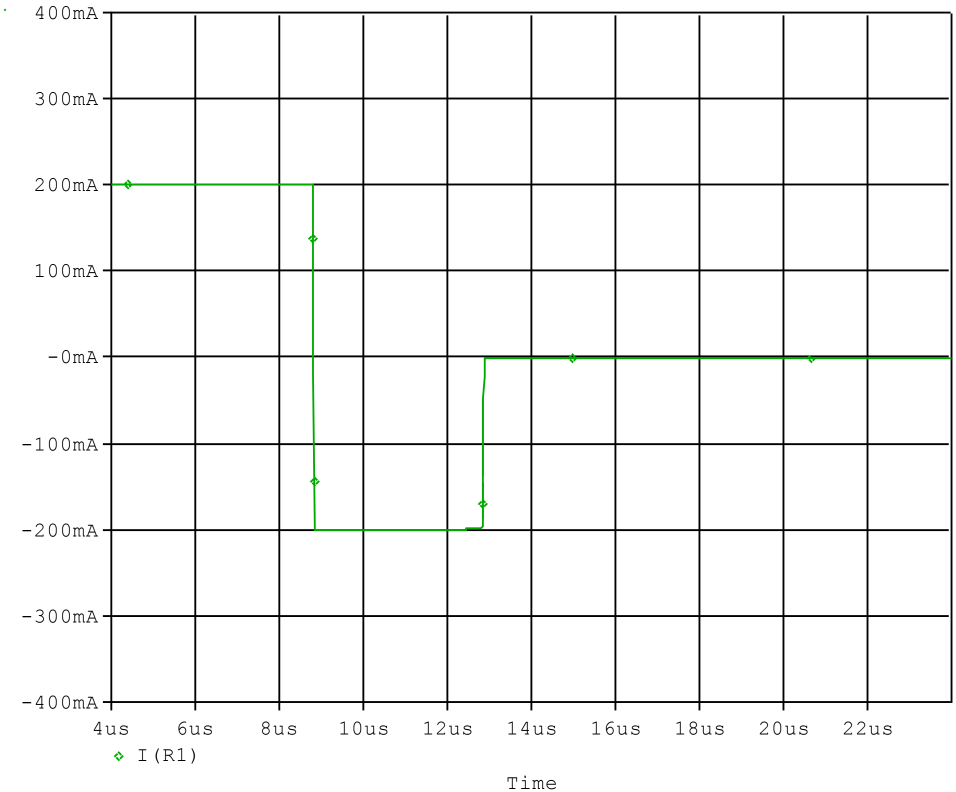


Simulation Result

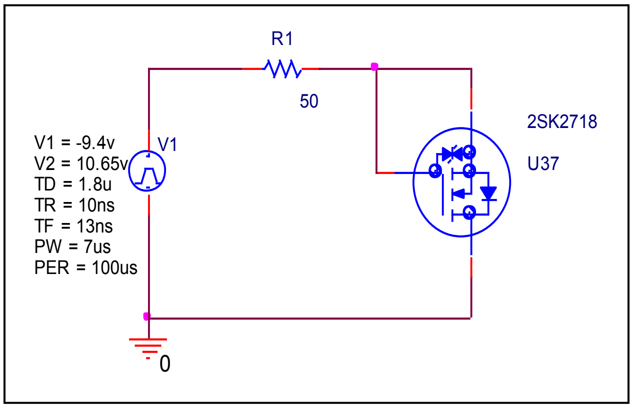
IDR(A)	VSD(V)		%Error
	Measuremen	Simulation	
0.01	0.580	0.588	1.379
0.02	0.620	0.612	-1.290
0.05	0.650	0.644	-0.923
0.1	0.670	0.670	0.000
0.2	0.700	0.697	-0.429
0.5	0.730	0.740	1.370
1	0.790	0.784	-0.759
2	0.850	0.850	0.000

Reverse Recovery Characteristic

Circuit Simulation Result



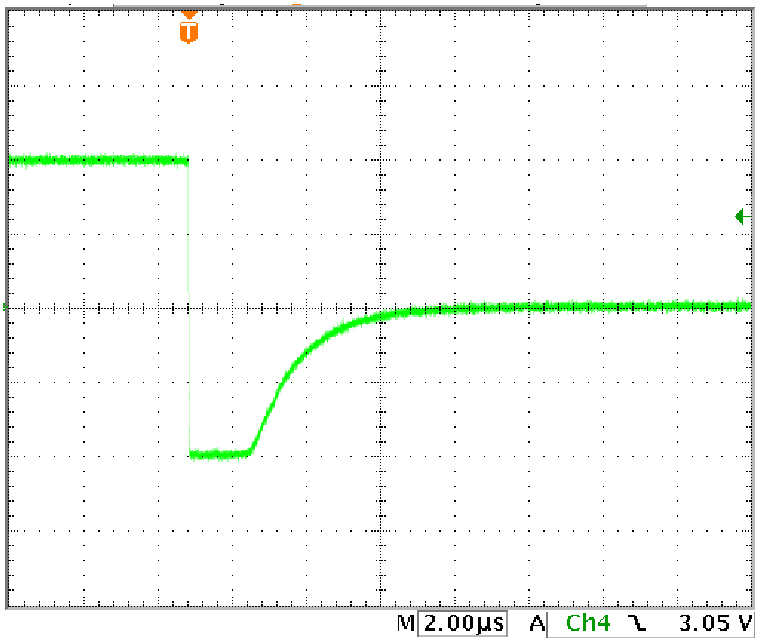
Evaluation Circuit



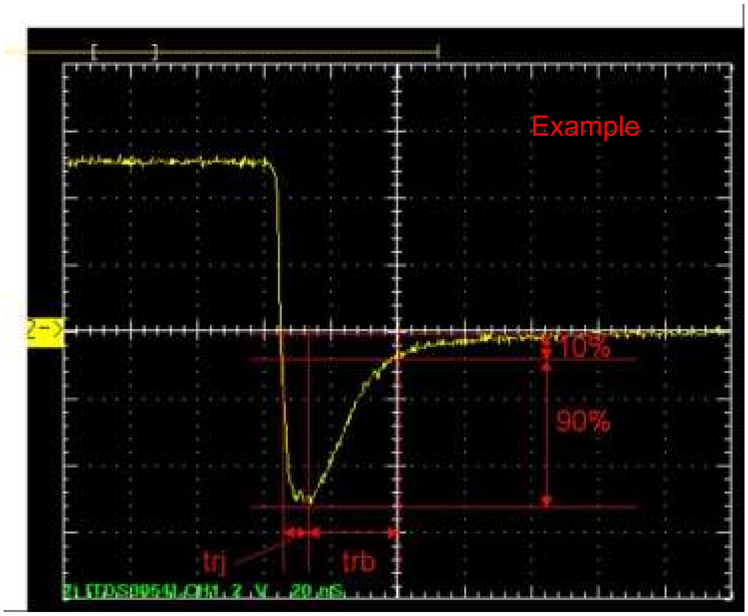
Compare Measurement vs. Simulation

Trr	Measurement	Simulation	Error (%)
Trj+Trb(us)	**4.000**	**4.058**	**1.450**

Reverse Recovery Characteristic   Reference



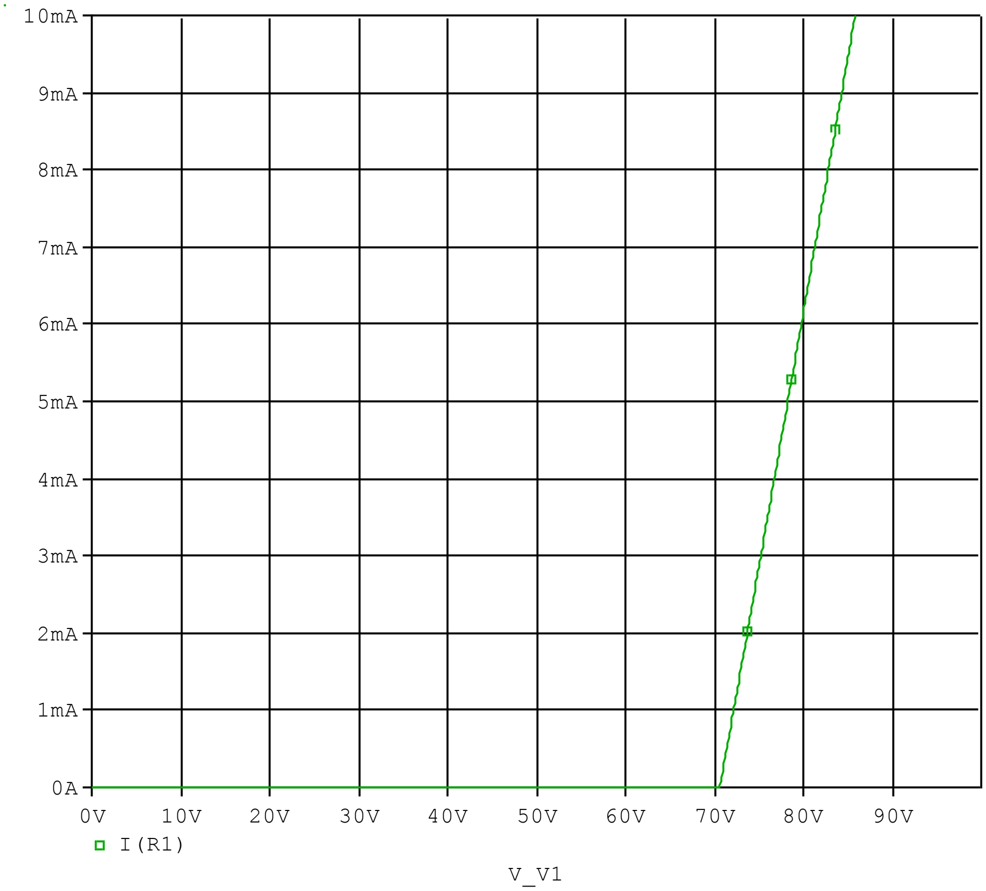
Trj= 1.75(us)
Trb=2.250(us)
Conditions:Ifwd=Irev=0.2(A),Rl=50



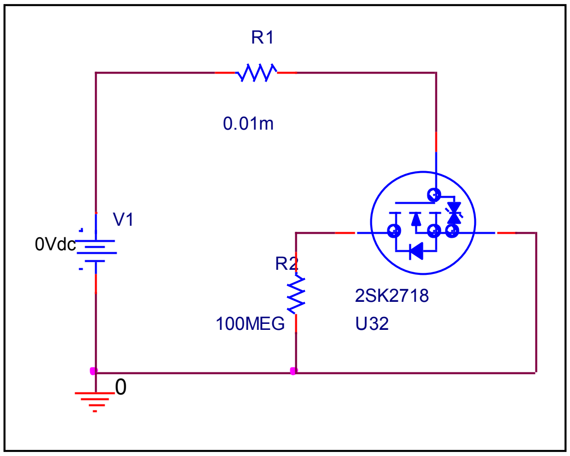
Relation between trj and trb

ESD PROTECTION DIODE
Zener Voltage Characteristic

Circuit Simulation Result

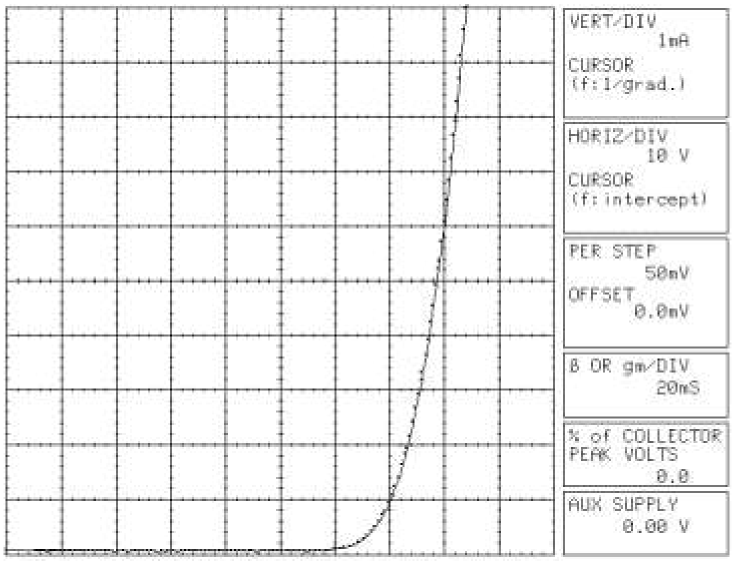


Evaluation Circuit



Zener Voltage Characteristic

Reference



VERT/DIV 1mA

CURSOR (f:1/grad.)

HORIZ/DIV 10 V

CURSOR (f:intercept)

PER STEP 50mV

OFFSET 0.0mV

β OR gm/DIV 20mS

% of COLLECTOR PEAK VOLTS 0.0

AUX SUPPLY 0.00 V