Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: 2SJ407
MANUFACTURER: TOSHIBA
REMARK: P Channel Model
Body Diode (Professional) / ESD Protection Diode

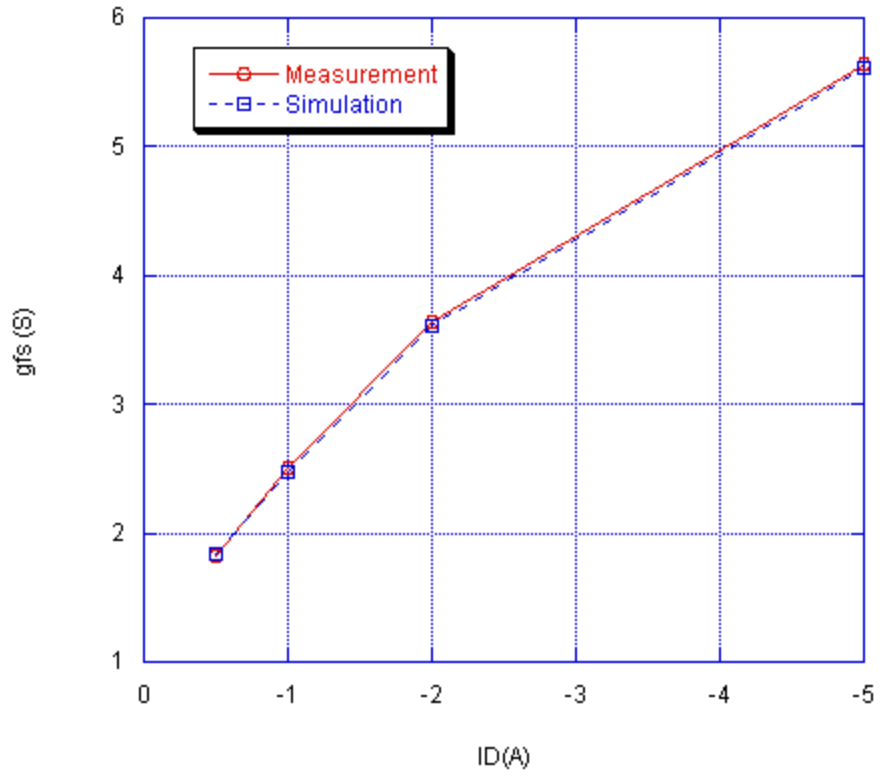
Bee Technologies Inc.

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

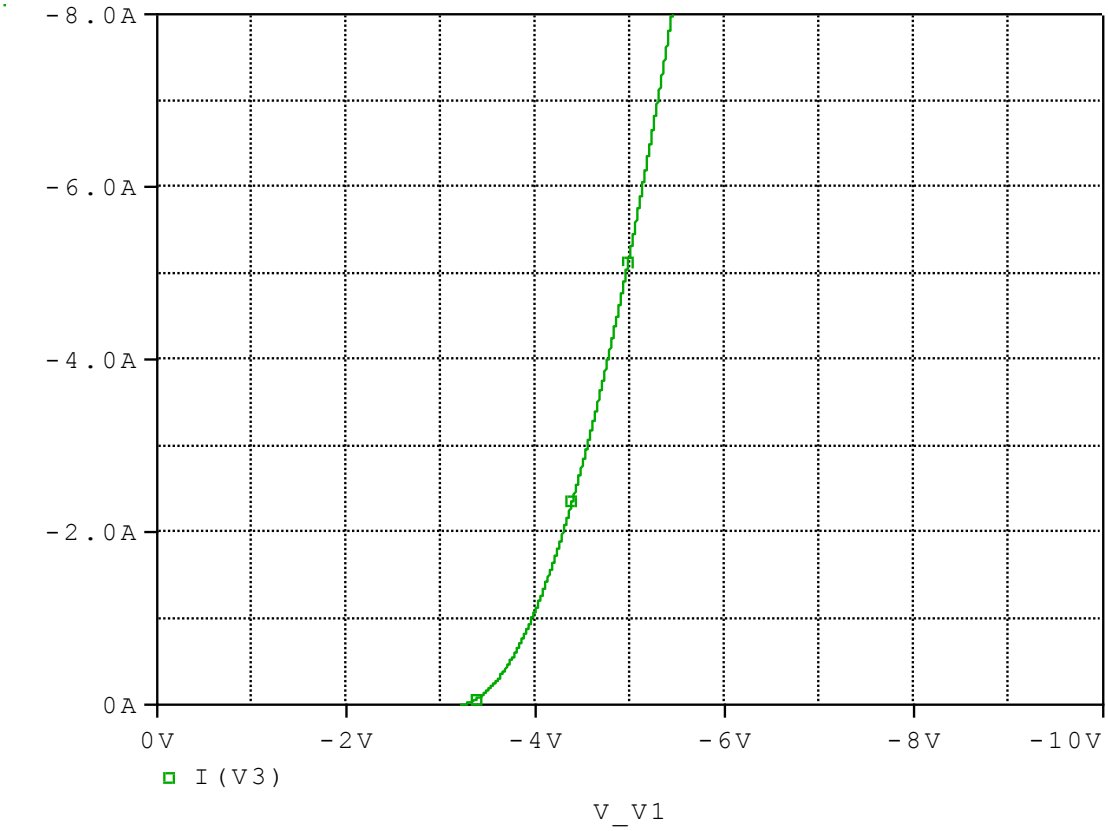


Comparison table

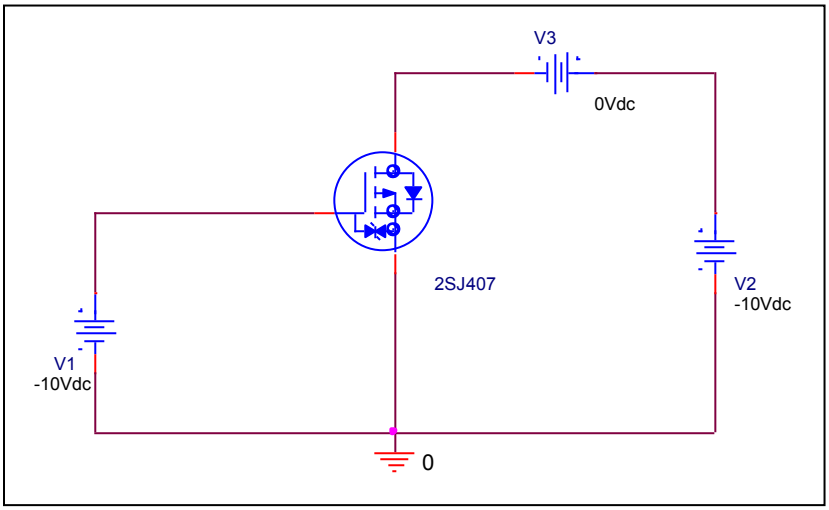
Id(A)	gfs		Error(%)
	Measurement	Simulation	
-0.500	1.818	1.845	1.476
-1.000	2.500	2.475	-0.990
-2.000	3.636	3.617	-0.542
-5.000	5.650	5.605	-0.785

Vgs-Id Characteristic

Circuit Simulation result

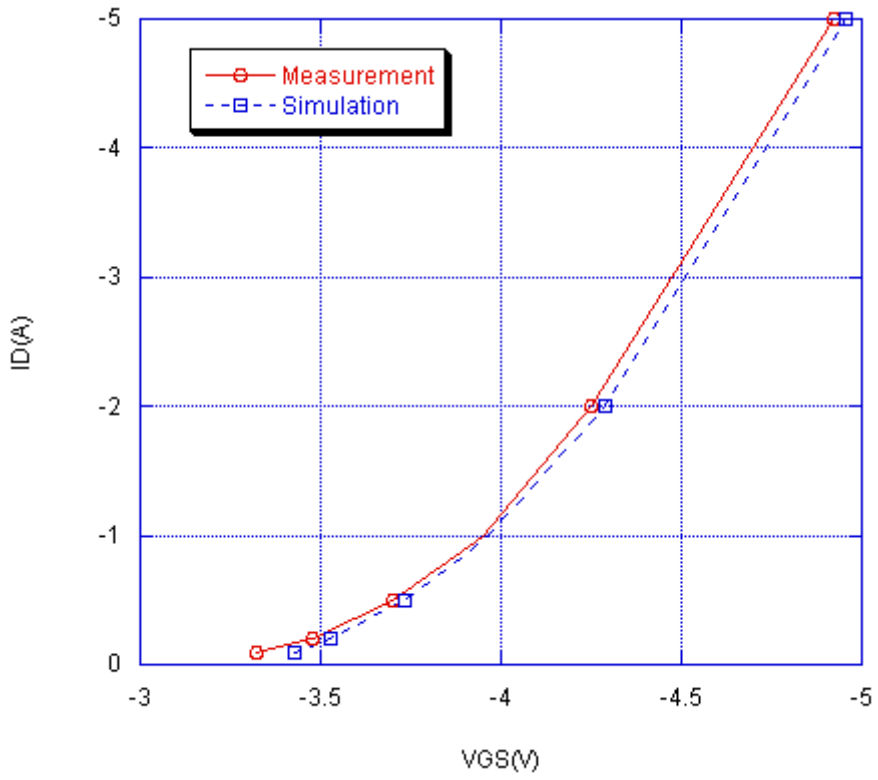


Evaluation circuit



Comparison Graph

Circuit Simulation Result

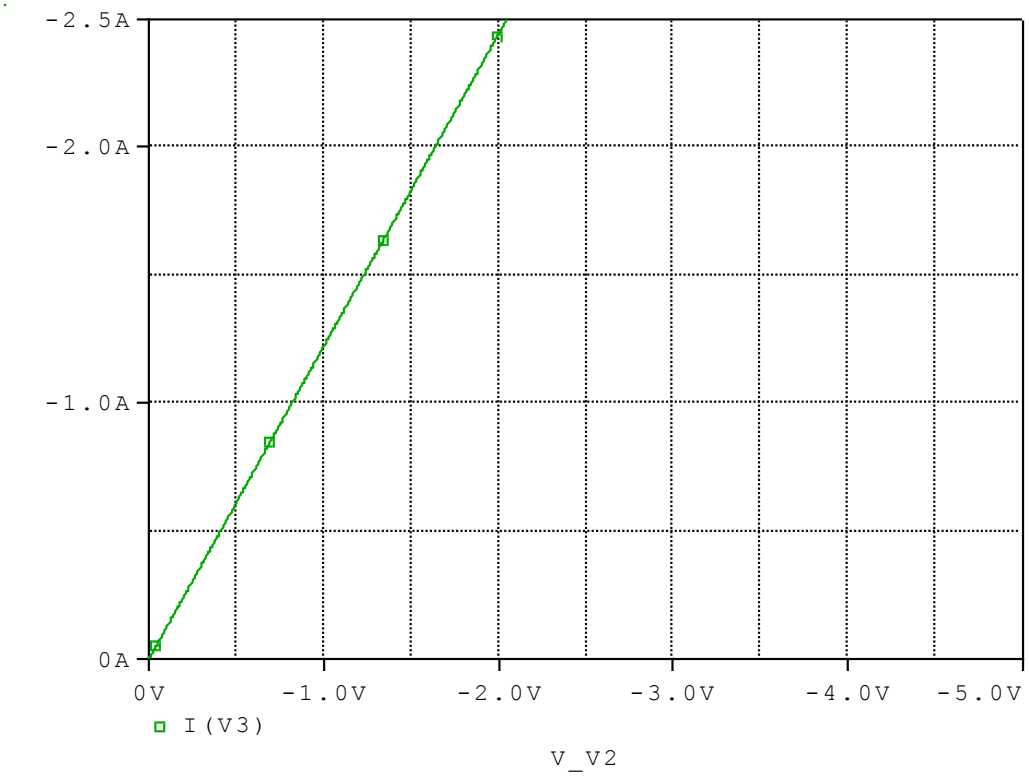


Simulation Result

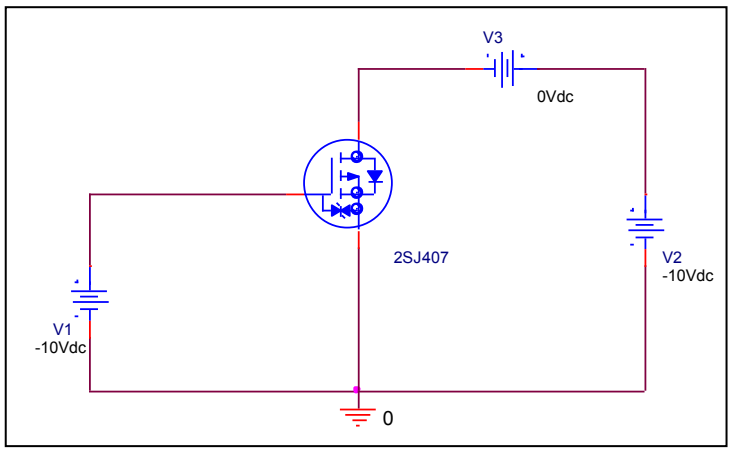
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
-0.100	-3.320	-3.425	3.163
-0.200	-3.475	-3.527	1.499
-0.500	-3.700	-3.731	0.827
-1.000	-3.950	-3.962	0.294
-2.000	-4.250	-4.291	0.967
-5.000	-4.920	-4.955	0.715

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

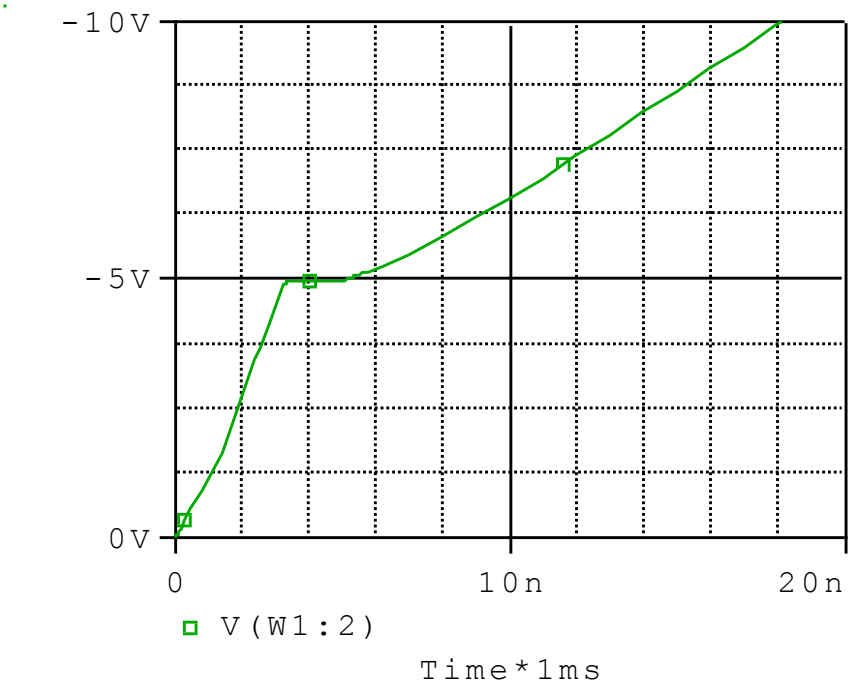


Simulation Result

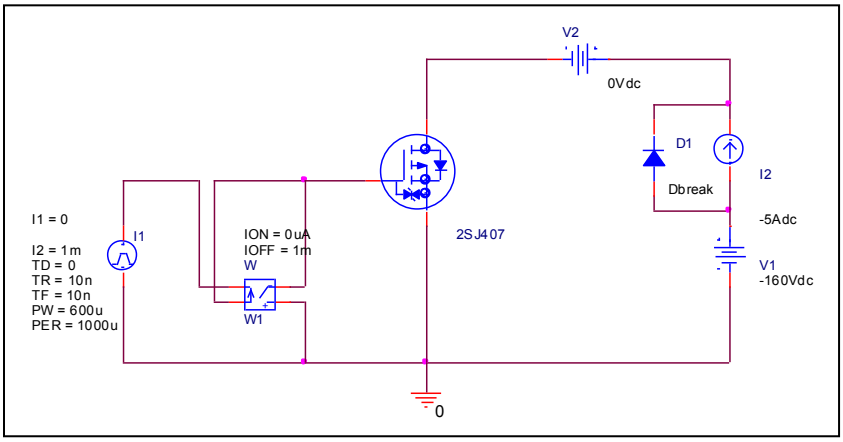
I_D=-2.5A, V_{GS}=-10V	Measurement		Simulation		Error (%)
R_{DS} (on)	0.800	Ω	0.800	Ω	0.000

Gate Charge Characteristic

Circuit Simulation result



Evaluation circuit

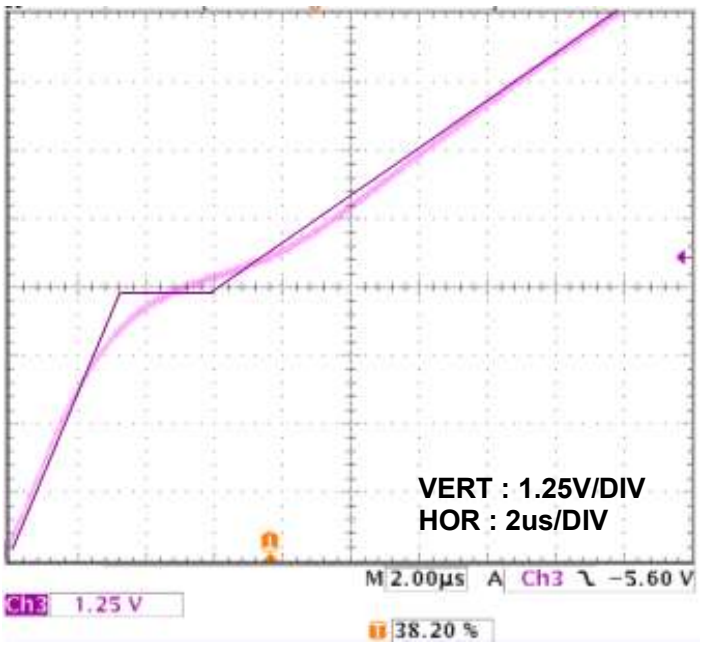


Simulation Result

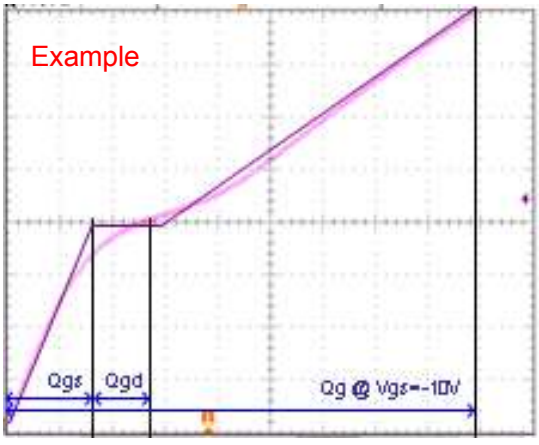
V_{DD}=-15V,I_D=-5A ,V_{GS}=-10V	Measurement		Simulation		Error (%)
Qgs	3.200	nC	3.211	nC	0.344
Qgd	2.700	nC	2.674	nC	-0.963
Qg	17.950	nC	18.069	nC	0.663

Gate Charge Characteristic

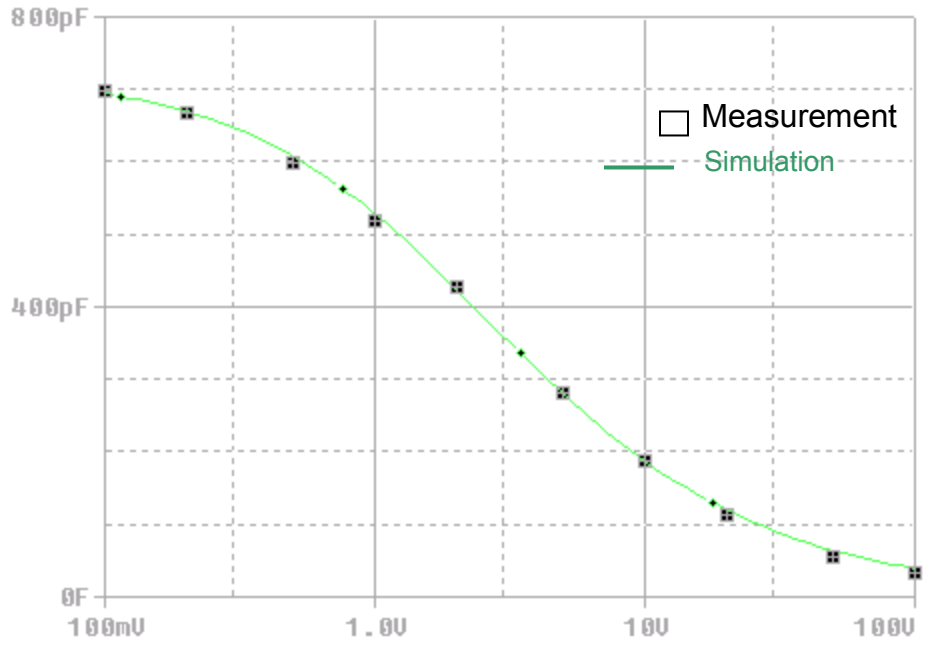
Reference



Qgs=3.2(nc)
Qgd=2.75(nc)
Qg=17.95(nc)
Conditions: V_{DD}=-15V,I_D=-5A,V_{GS}=-10V, IG=1mA



Capacitance Characteristic

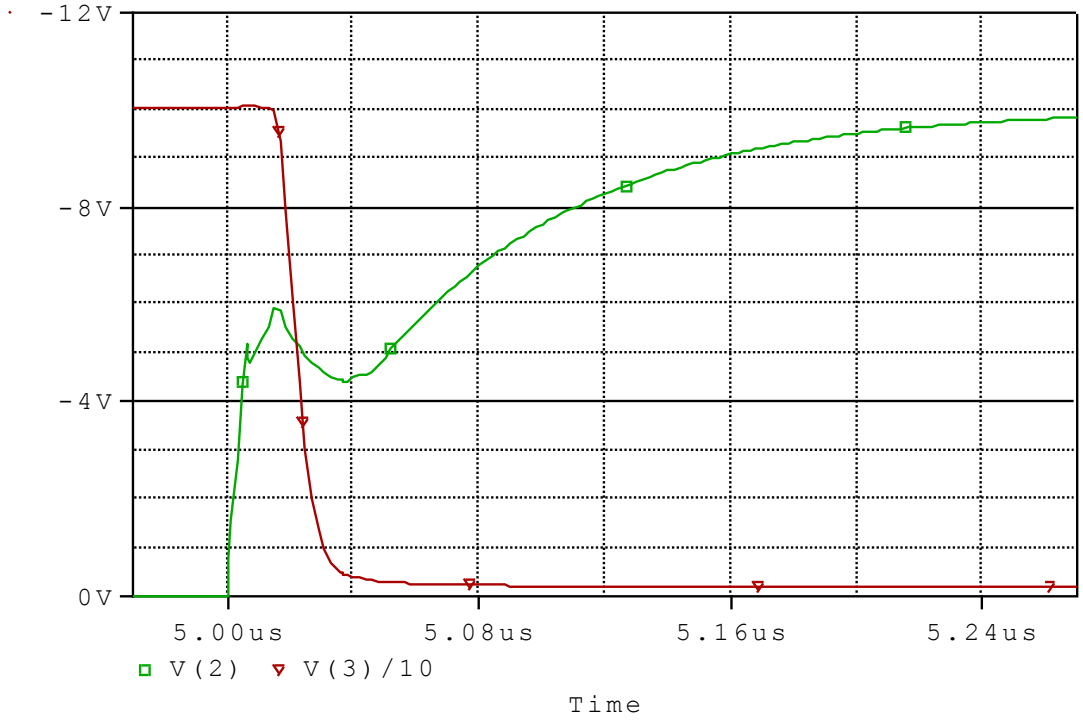


Simulation Result

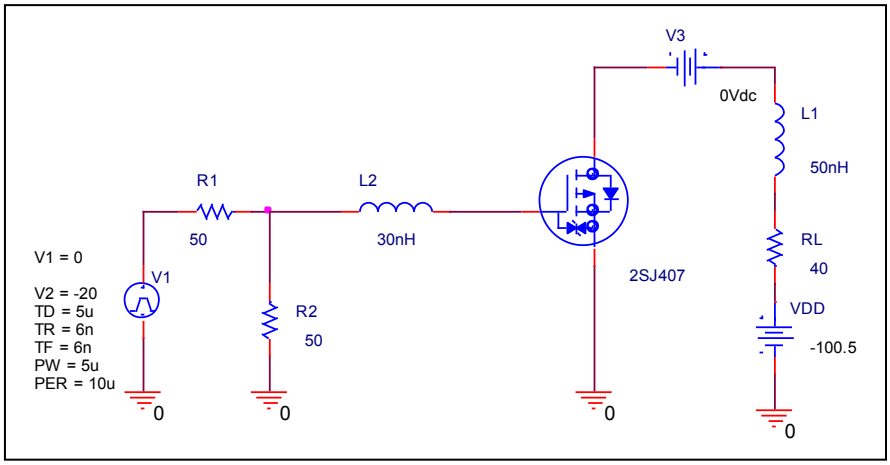
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	700.000	694.000	-0.857
0.200	670.000	669.000	-0.149
0.500	600.000	605.000	0.833
1.000	520.000	527.000	1.346
2.000	430.000	425.000	-1.163
5.000	285.000	280.000	-1.754
10.000	190.000	187.000	-1.579
20.000	117.000	119.000	1.709
50.000	61.000	63.000	3.279
100.000	37.000	38.000	2.703

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

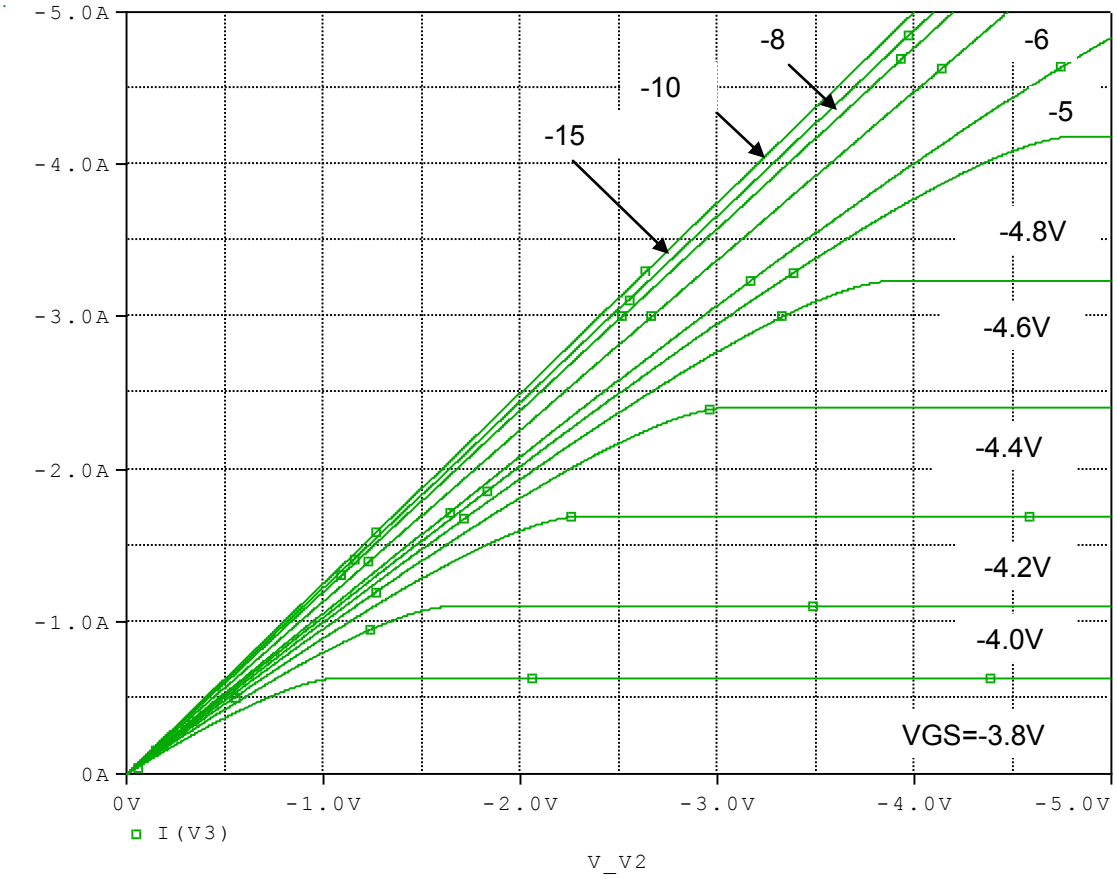


Simulation Result

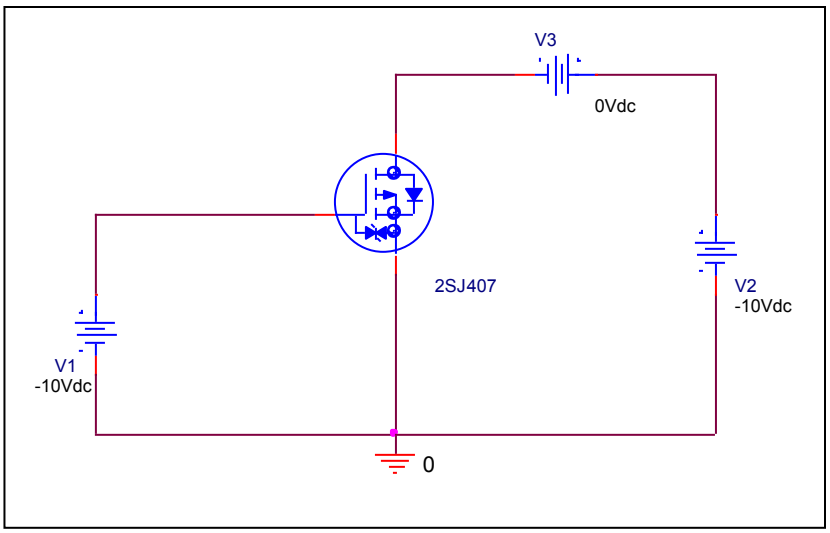
I_D=-2.5A, V_{DD}=-100V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	30.000	ns	29.957	ns	-0.143

Output Characteristic

Circuit Simulation result

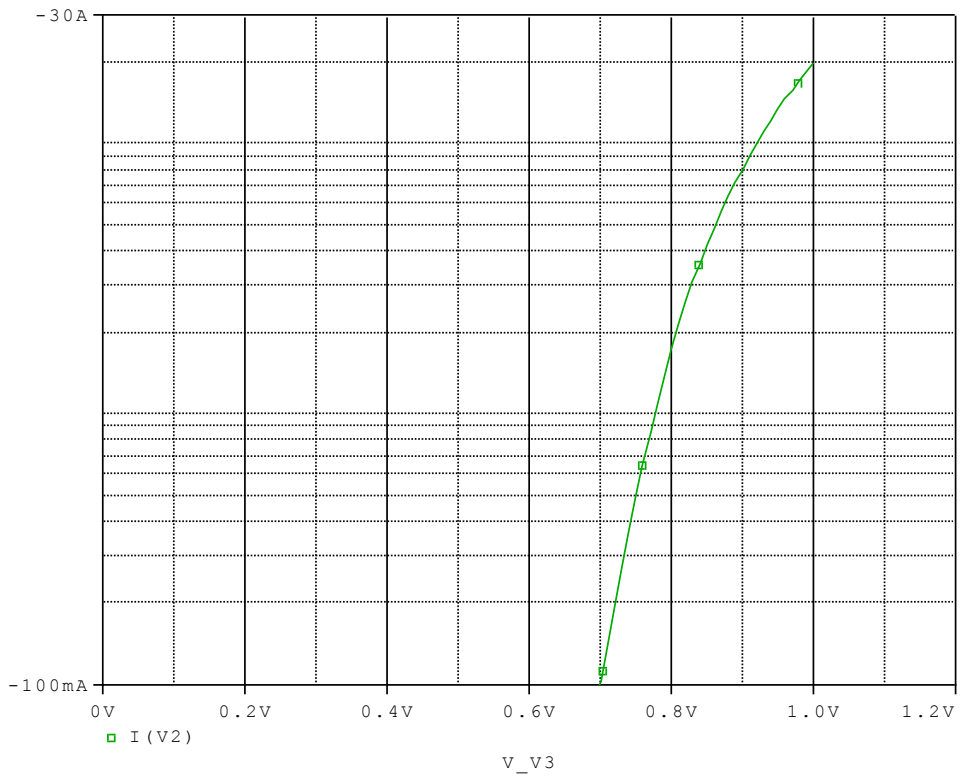


Evaluation circuit

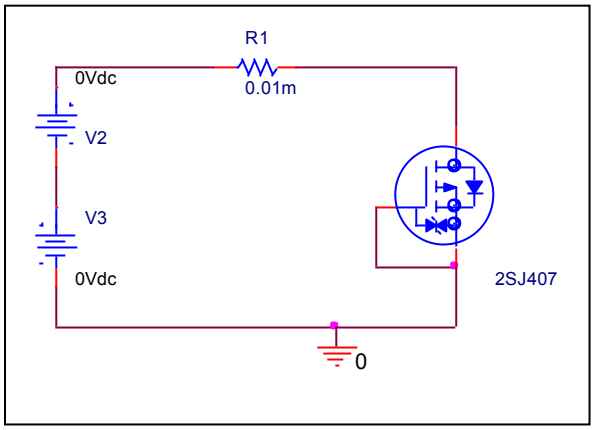


Forward Current Characteristic

Circuit Simulation Result

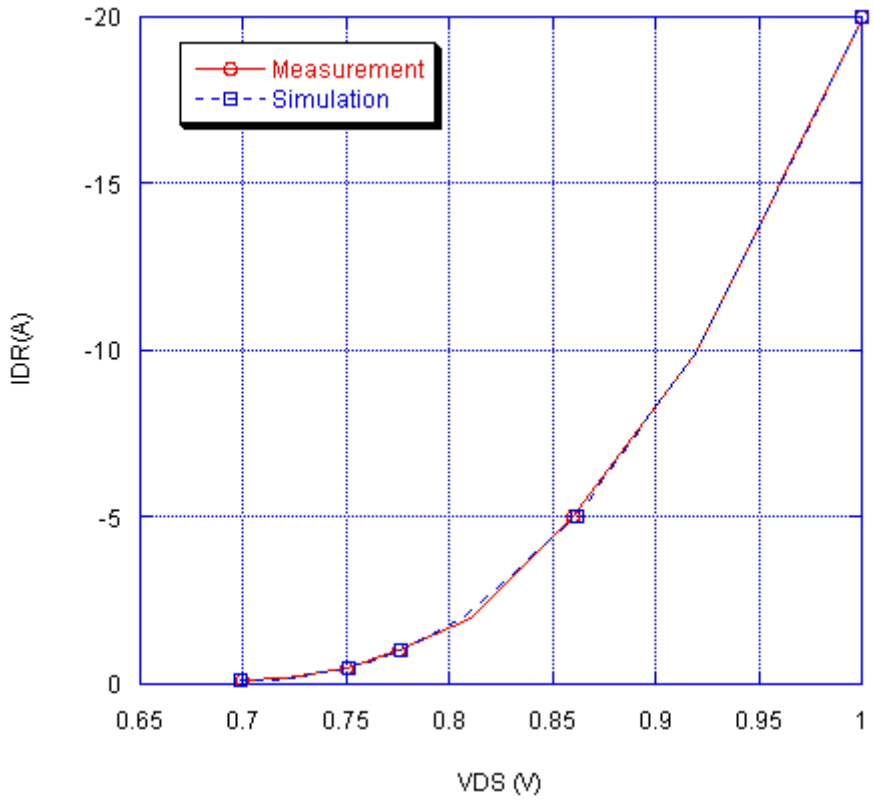


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

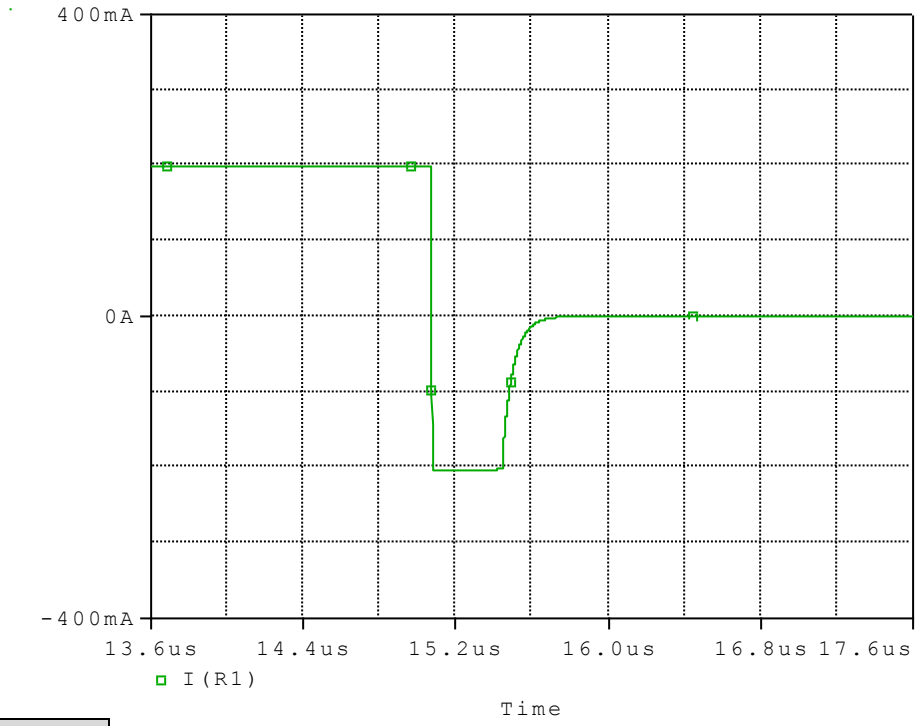


Simulation Result

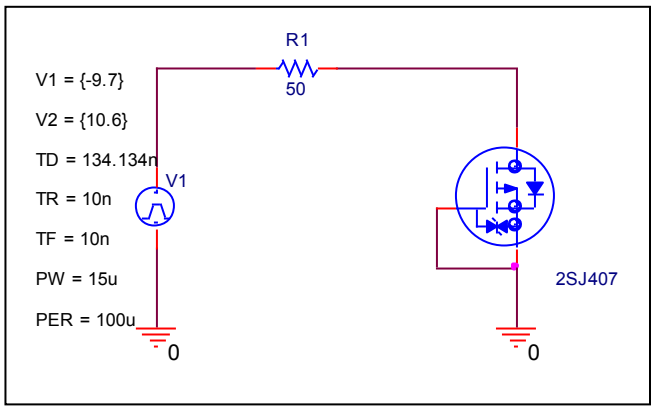
IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
-0.100	0.700	0.699	-0.143
-0.200	0.720	0.721	0.139
-0.500	0.750	0.751	0.133
-1.000	0.775	0.776	0.129
-2.000	0.810	0.807	-0.370
-5.000	0.860	0.862	0.233
-10.000	0.920	0.920	0.000
-20.000	1.000	1.000	0.000

Reverse Recovery Characteristic

Circuit Simulation Result



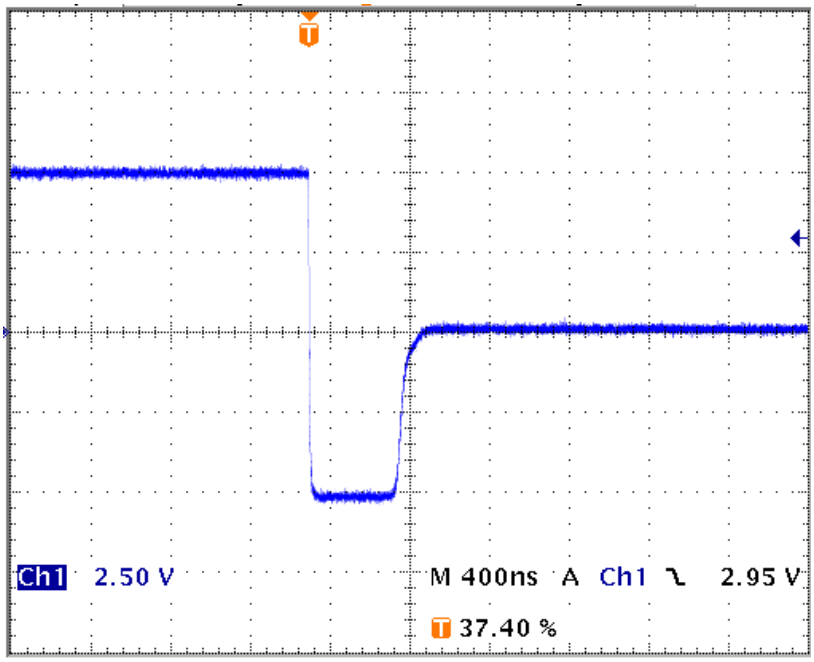
Evaluation Circuit



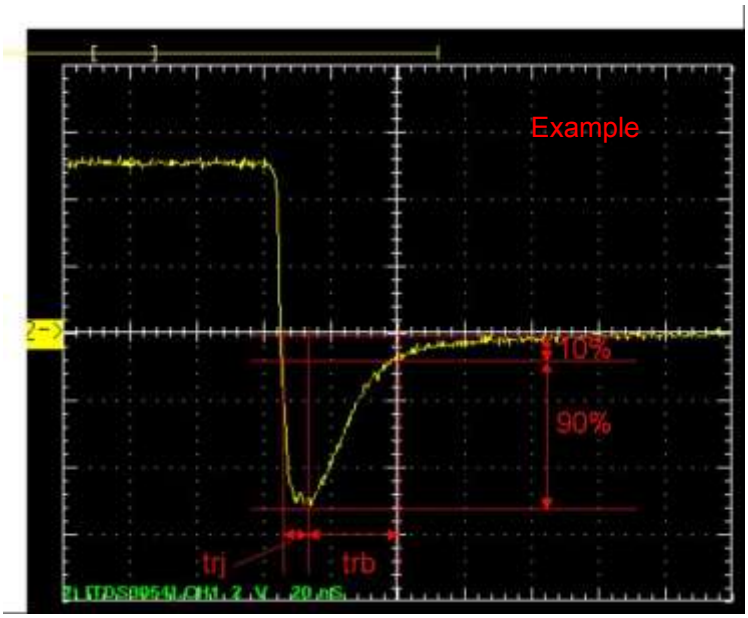
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	**384.000**	**ns**	**383.415**	**ns**	**-0.152**
trb	**136.000**	**ns**	**137.457**	**ns**	**1.071**
trr	**520.000**	**ns**	**520.872**	**ns**	**0.168**

Reverse Recovery Characteristic Reference



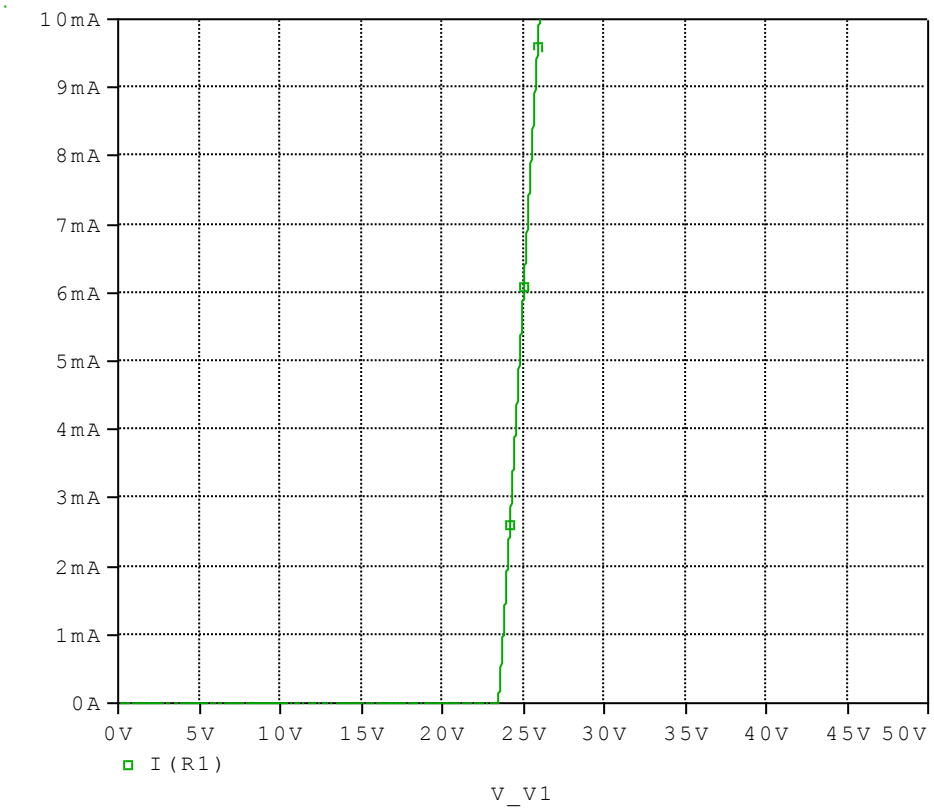
Trj=384(ns)
Trb=136(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



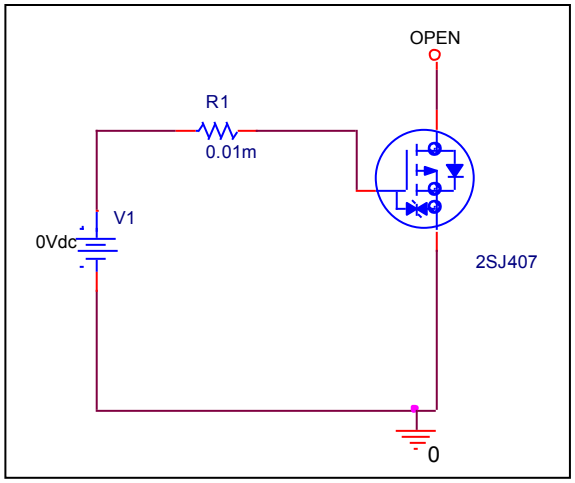
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference