Device Modeling Report

COMPONENTS: MOSFET (Professional)
PART NUMBER: SSM6P54TU
MANUFACTURER: TOSHIBA
REMARK: P Channel Model
Body Diode (Professional) / ESD Protection Diode

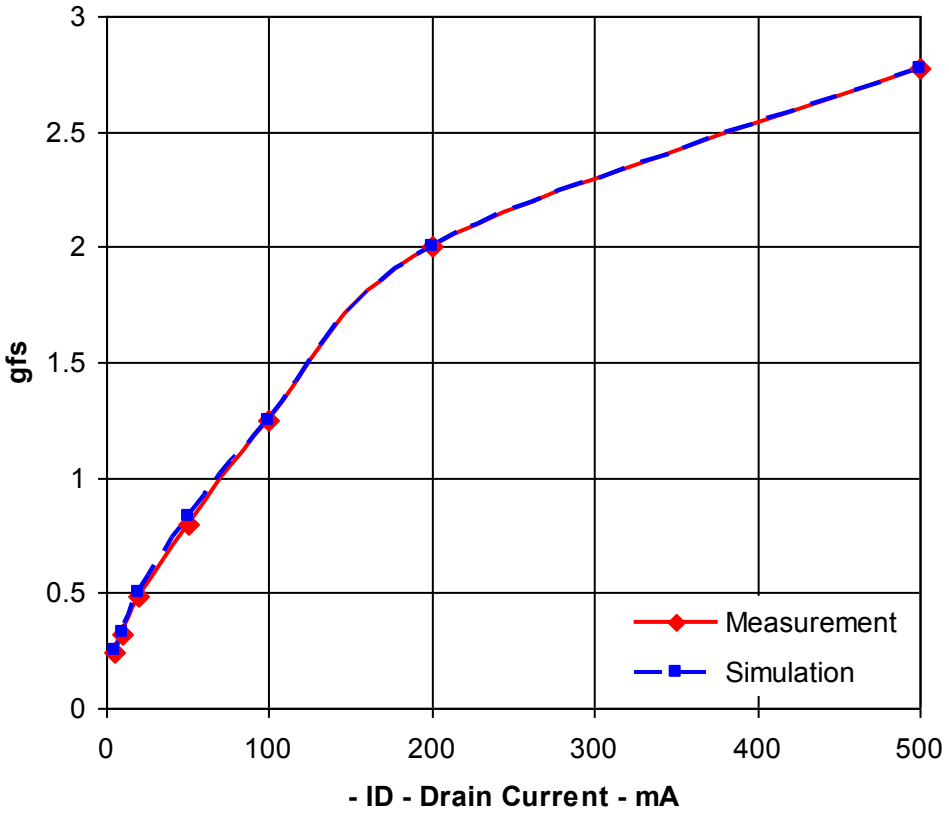
Bee Technologies Inc.

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

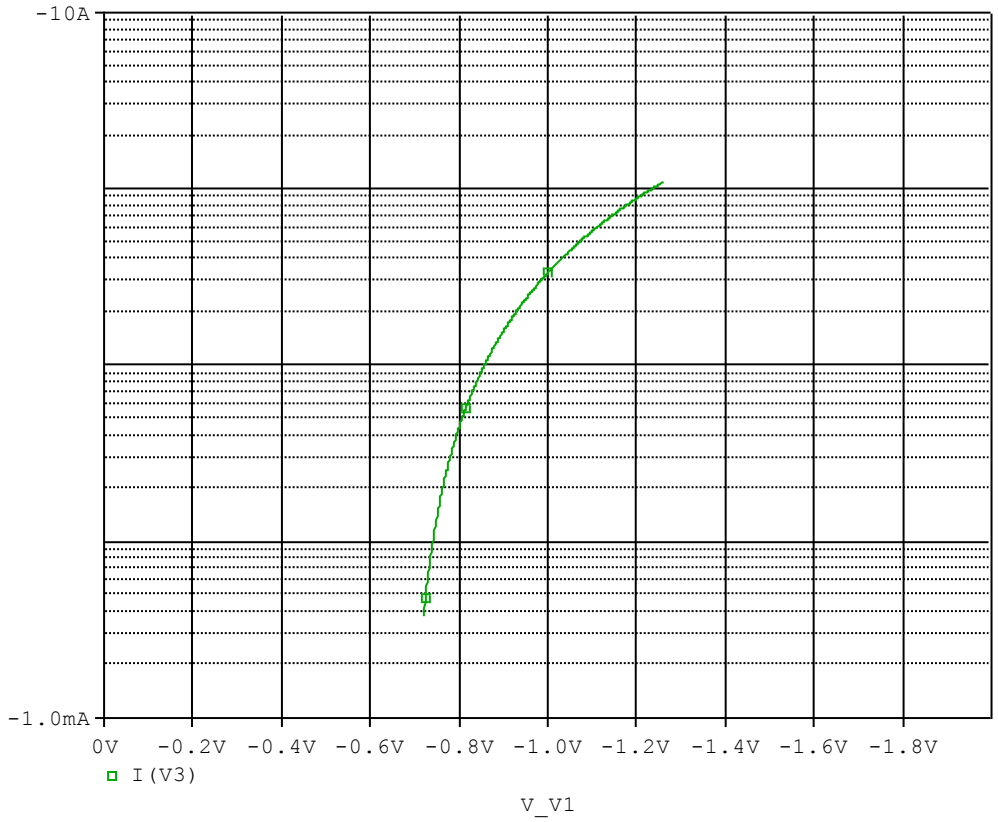


Comparison table

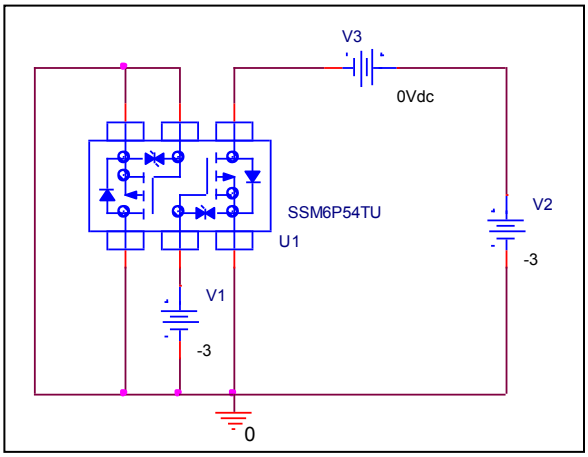
-Id(mA)	gfs		Error(%)
	Measurement	Simulation	
5	0.240	0.250	4.167
10	0.317	0.333	5.047
20	0.483	0.500	3.520
50	0.800	0.833	4.125
100	1.250	1.250	0.000
200	2.000	2.000	0.000
500	2.778	2.778	0.000

Vgs-Id Characteristic

Circuit Simulation result

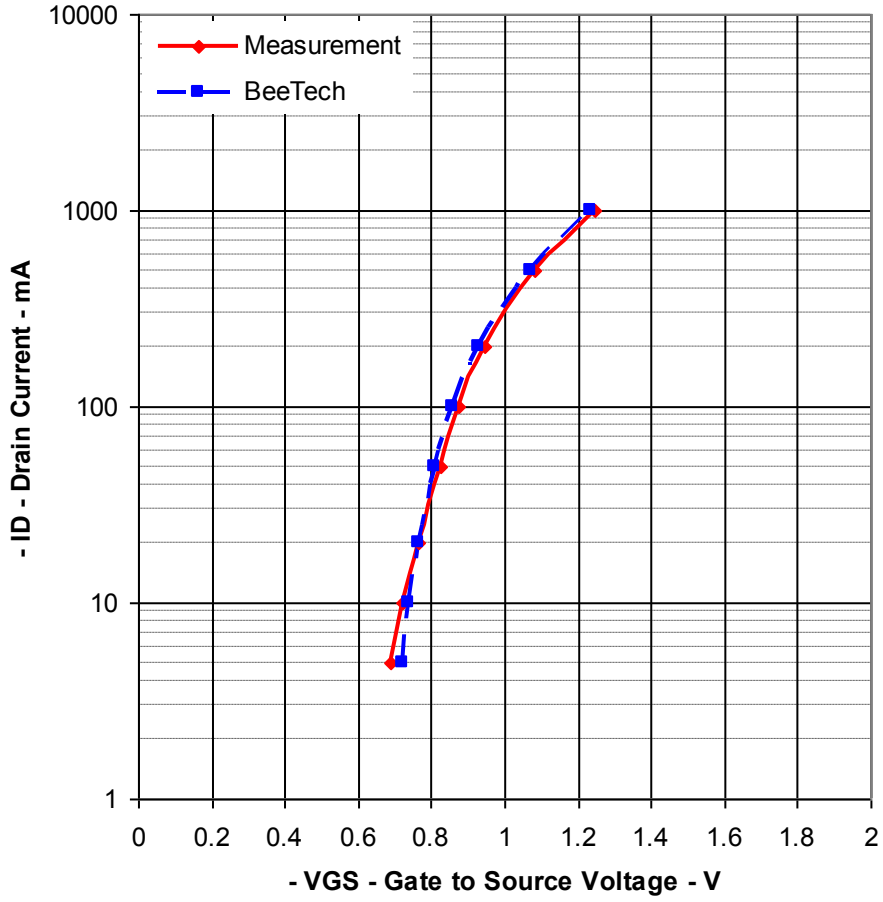


Evaluation circuit



Comparison Graph

Circuit Simulation Result

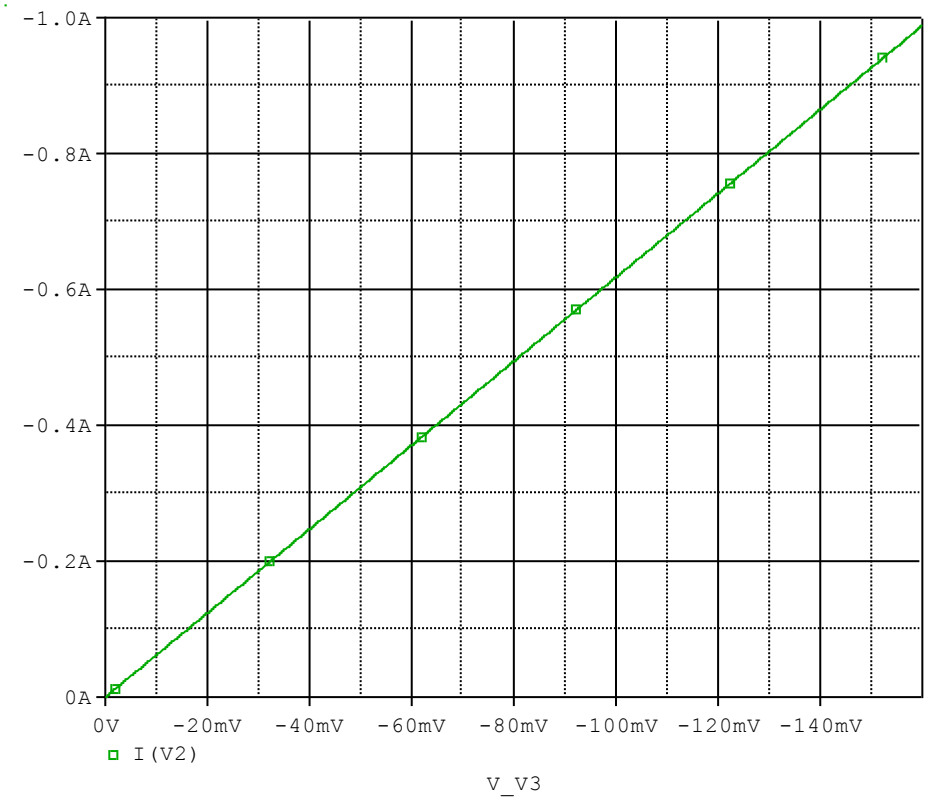


Simulation Result

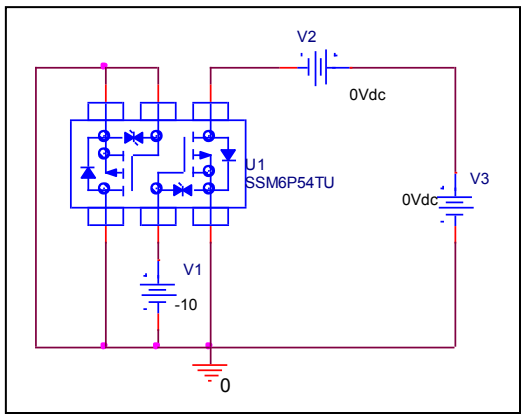
$-I_D$(mA)	$-V_{GS}$(V)		Error (%)
	Measurement	Simulation	
5	0.690	0.724	4.928
10	0.720	0.740	2.778
20	0.765	0.763	-0.261
50	0.824	0.807	-2.063
100	0.875	0.857	-2.057
200	0.945	0.928	-1.799
500	1.080	1.070	-0.926
1000	1.245	1.236	-0.723

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

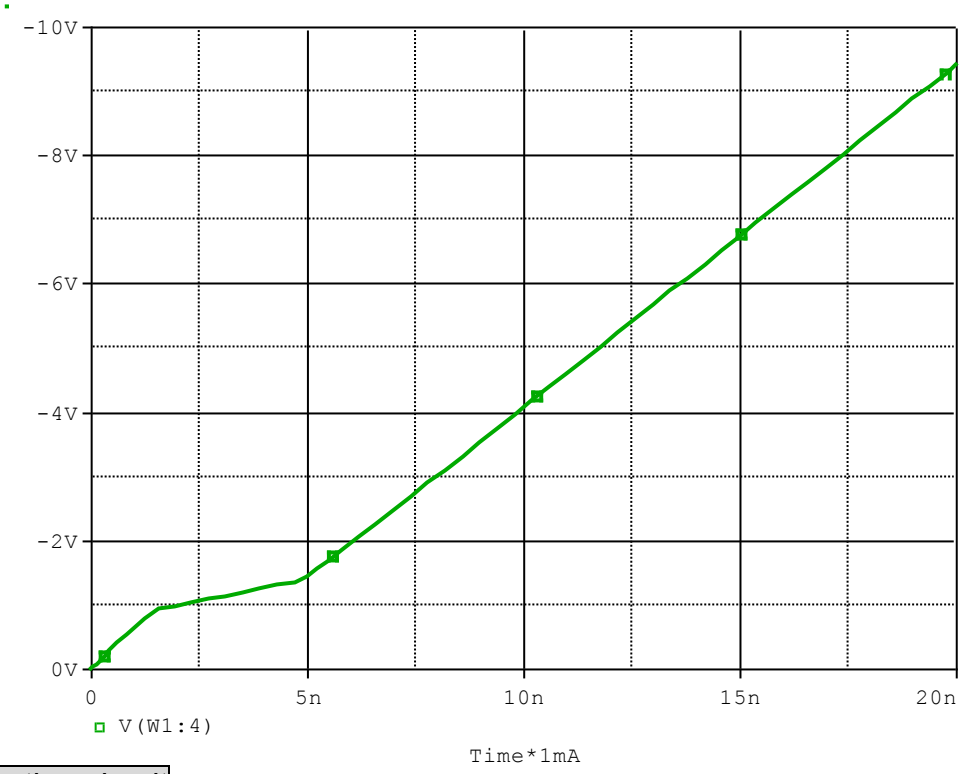


Simulation Result

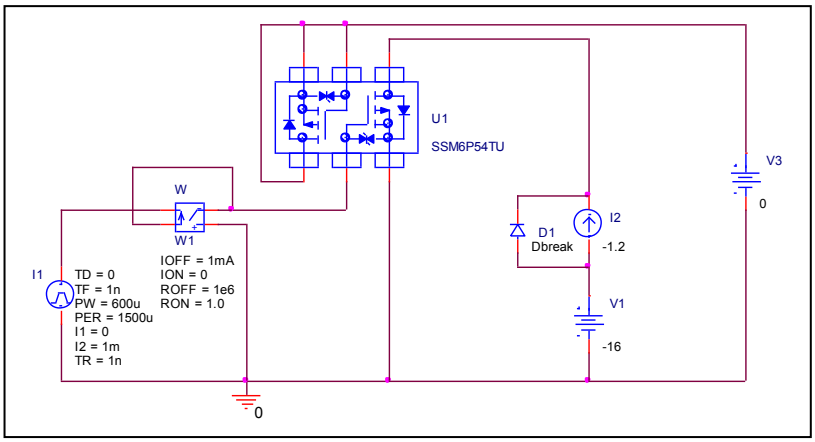
I_D=-0.6A, V_{GS}=-2.5V	Measurement		Simulation		Error (%)
R_{DS} (on)	162.000	mΩ	161.938	mΩ	-0.038

Gate Charge Characteristic

Circuit Simulation result



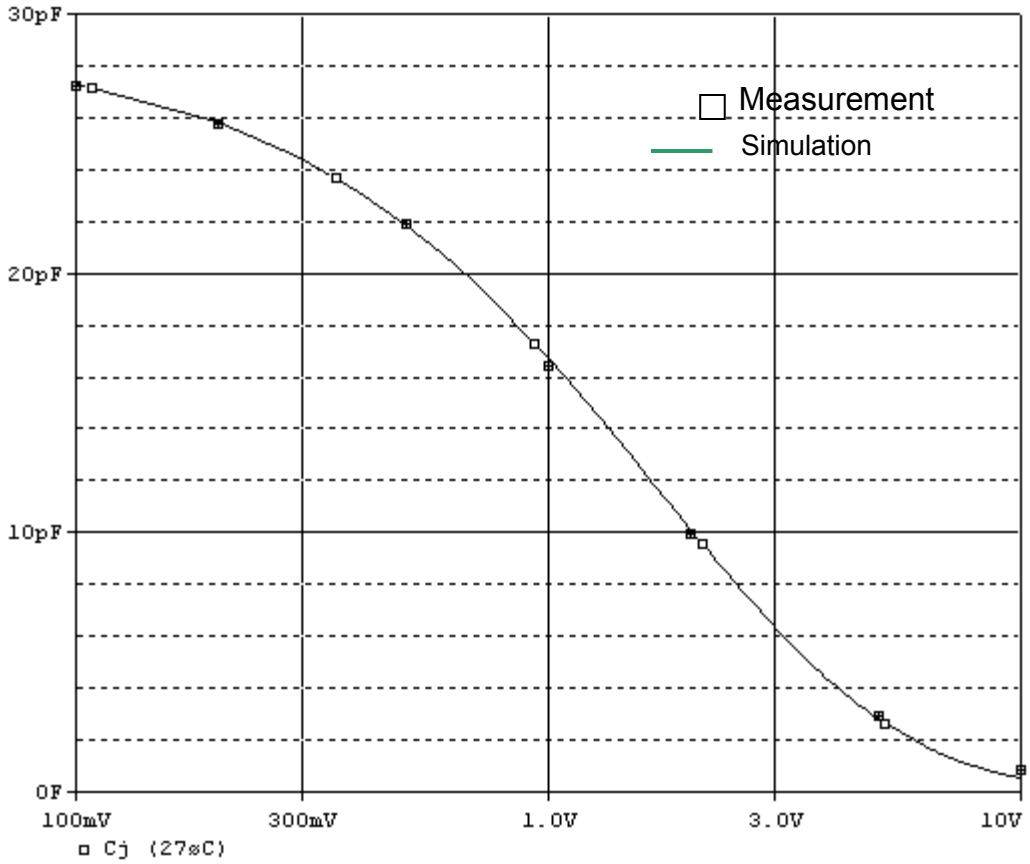
Evaluation circuit



Simulation Result

V_{DD}=-16V,I_D=-1.2A ,V_{GS}=-4V	Measurement		Simulation		Error (%)
Qgs	1.750	nC	1.684	nC	-3.771
Qgd	3.000	nC	2.877	nC	-4.100
Qg	8.000	nC	8.710	nC	4.940

Capacitance Characteristic

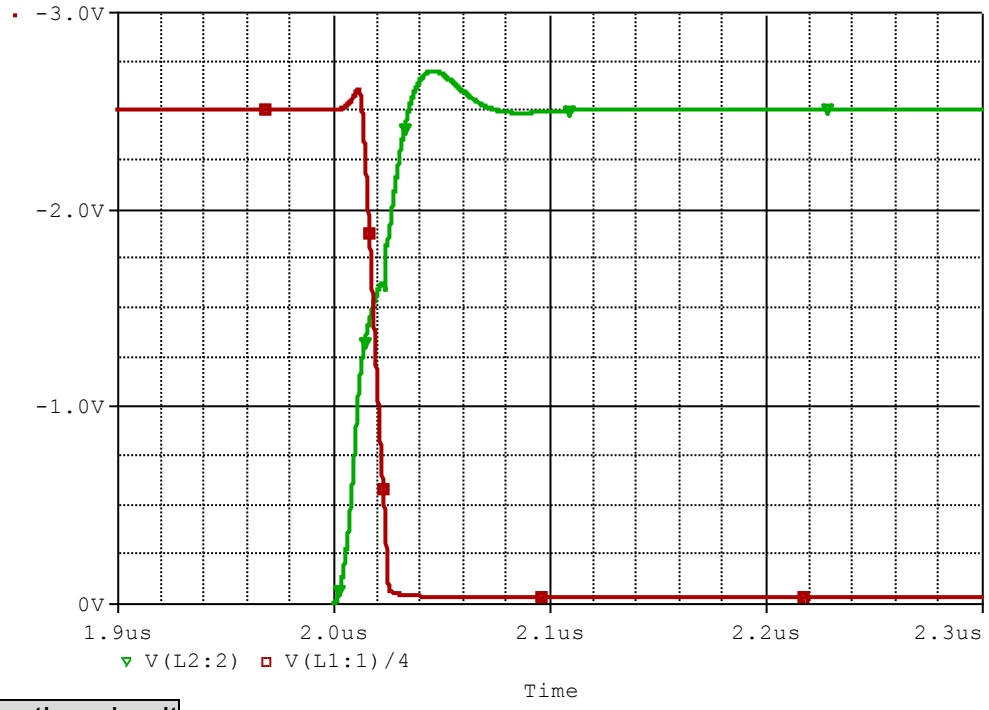


Simulation Result

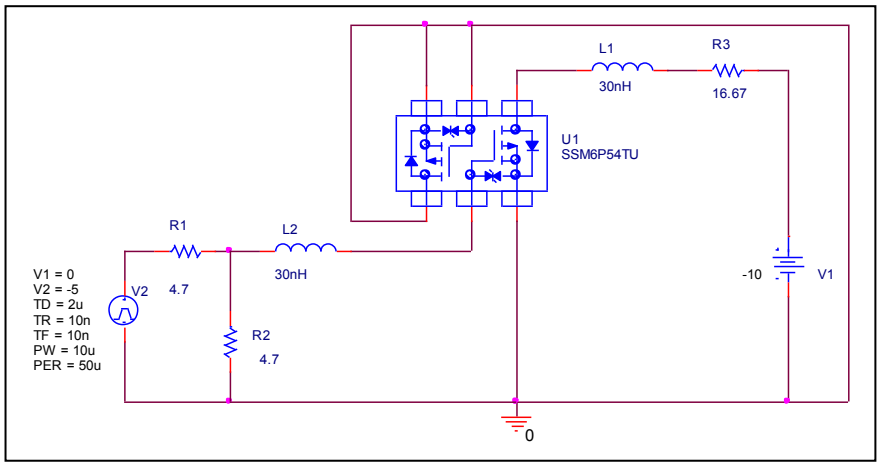
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	27.300	27.350	0.183
0.2	25.800	25.800	0.000
0.5	22.000	21.900	-0.455
1	16.500	16.650	0.909
2	10.000	10.100	1.000
5	3.000	2.900	-3.333
10	0.900	0.880	-2.222

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

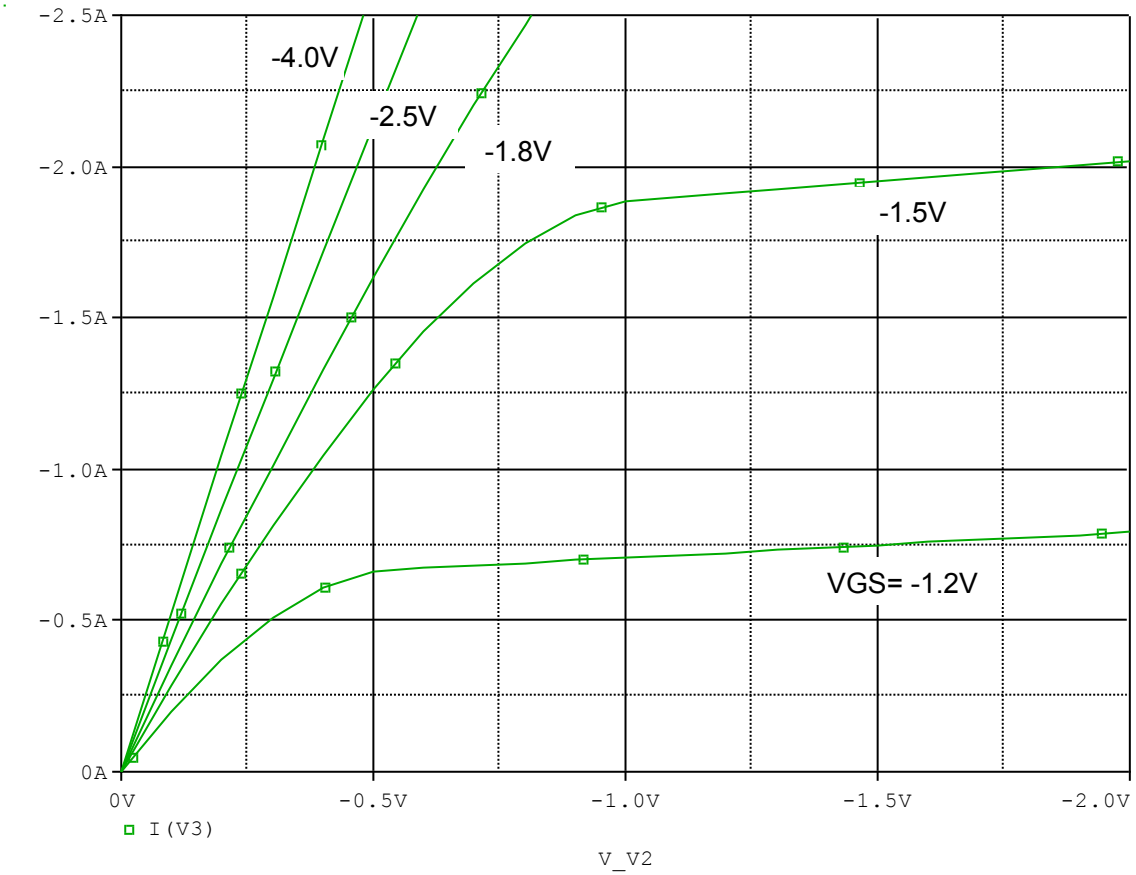


Simulation Result

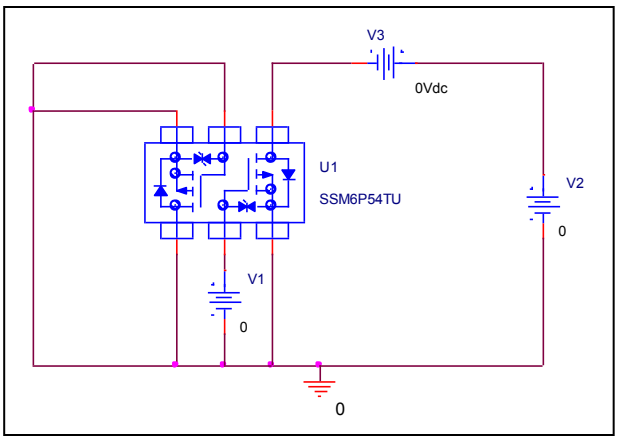
I_D=-0.6A, V_{DD}=-10V V_{GS}=-2.5V	Measurement		Simulation		Error(%)
ton	19.000	ns	18.982	ns	-0.095

Output Characteristic

Circuit Simulation result

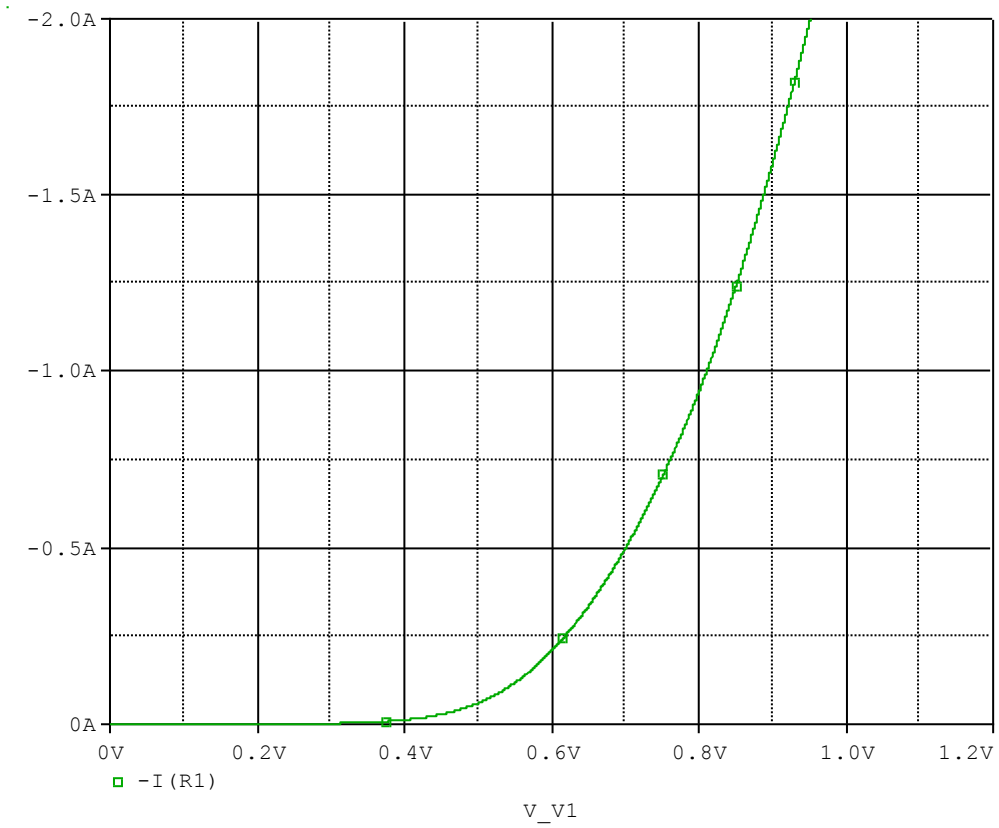


Evaluation circuit

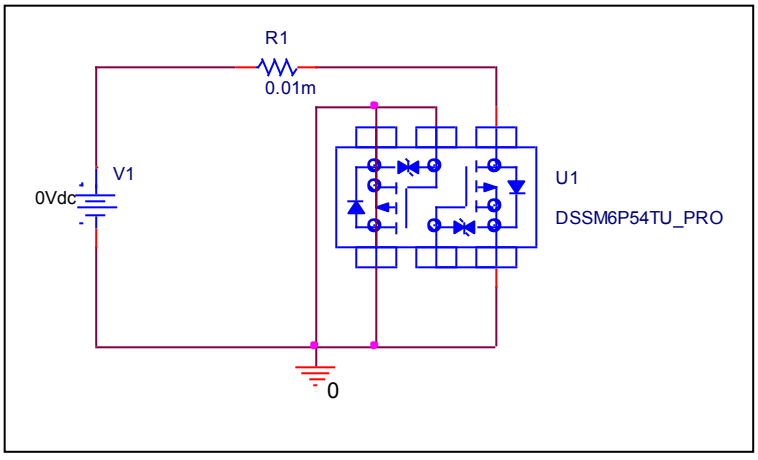


Forward Current Characteristic

Circuit Simulation Result

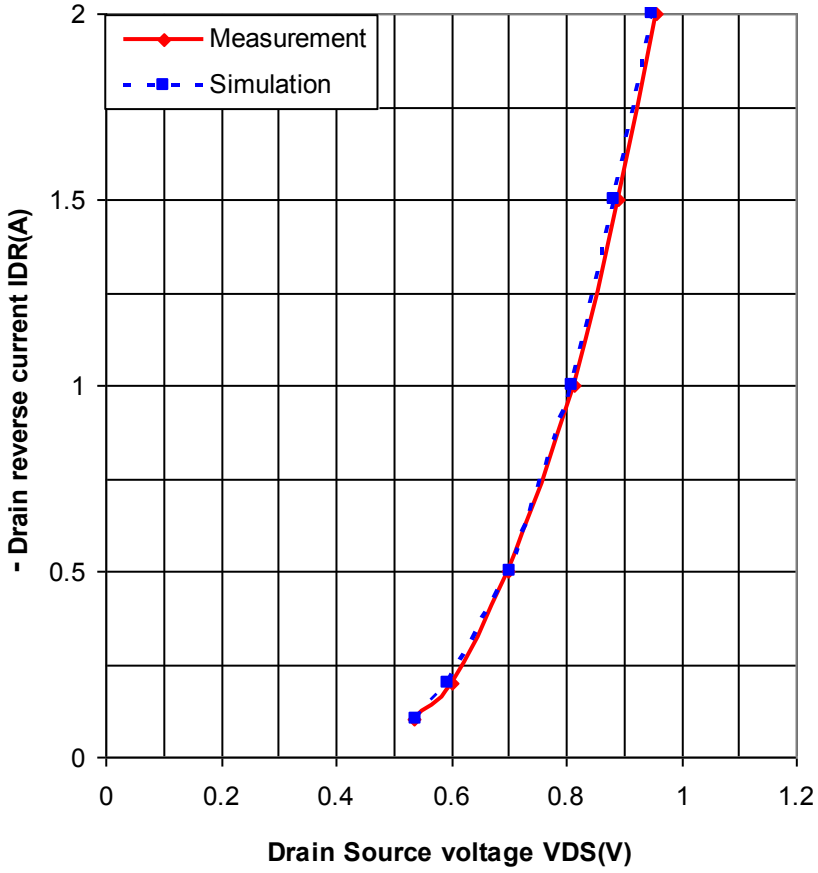


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

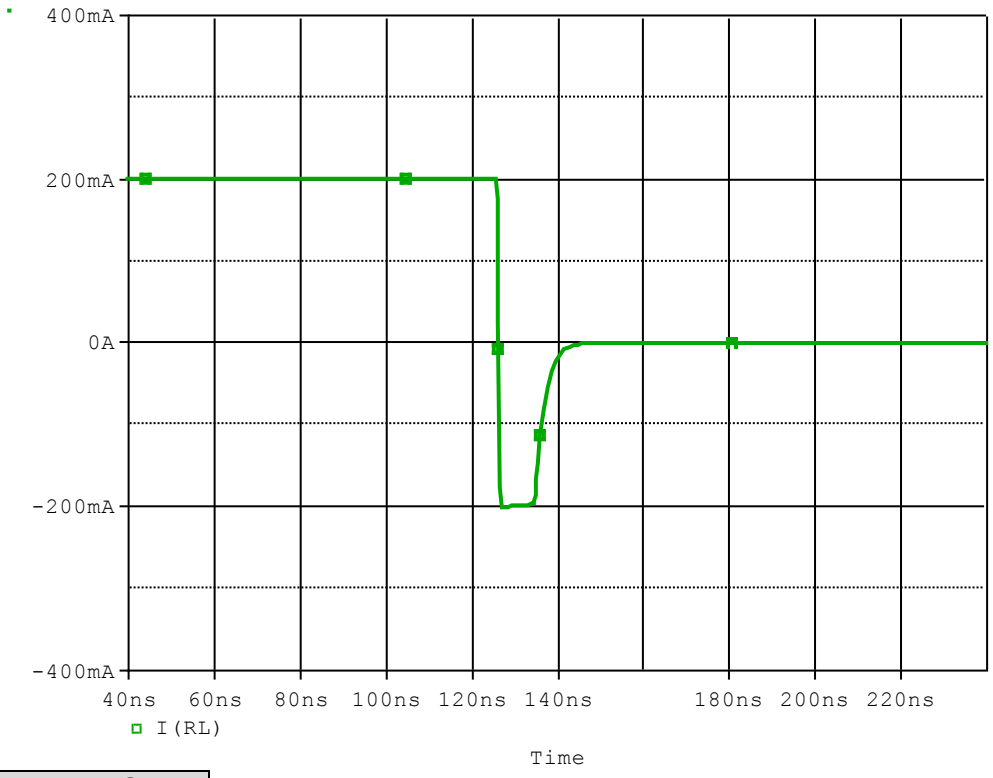


Simulation Result

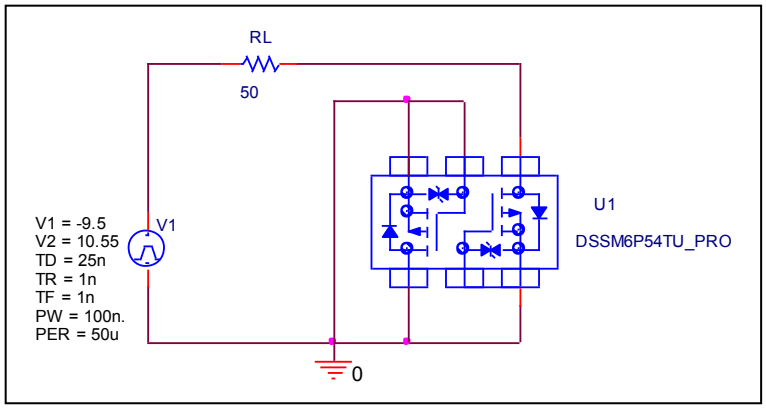
-IDR(A)	VDS(V) Measurement	VDS(V) Simulation	%Error
0.100	0.535	0.538	0.561
0.200	0.600	0.596	-0.667
0.500	0.700	0.701	0.143
1.000	0.815	0.810	-0.613
1.500	0.890	0.885	-0.562
2.000	0.955	0.948	-0.733

Reverse Recovery Characteristic

Circuit Simulation Result



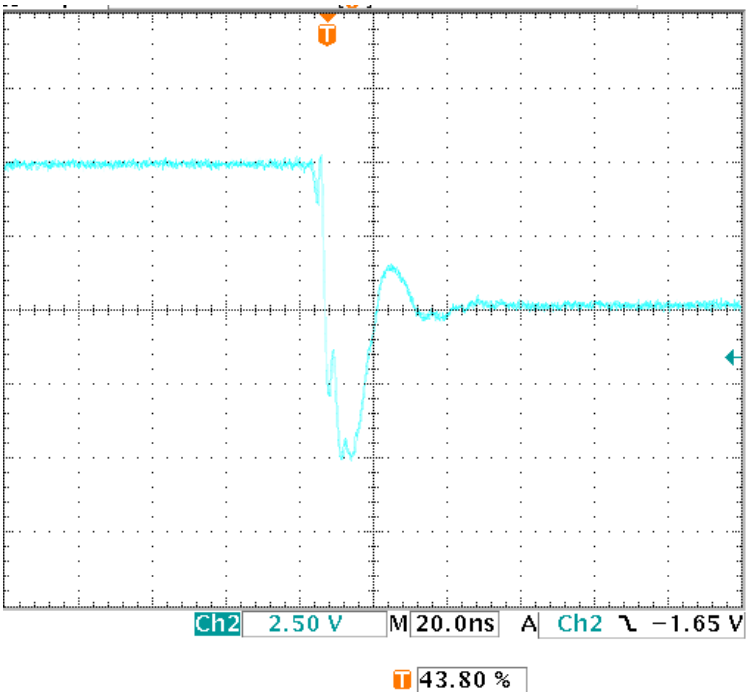
Evaluation Circuit



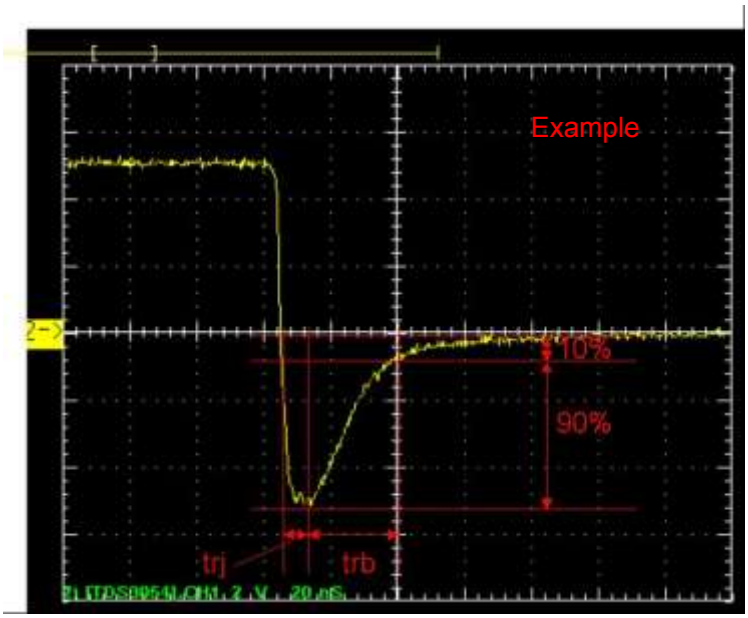
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	8.000	ns	8.014	ns	0.175
trb	5.600	ns	5.614	ns	0.250
trr	13.600	ns	13.628	ns	0.206

Reverse Recovery Characteristic Reference



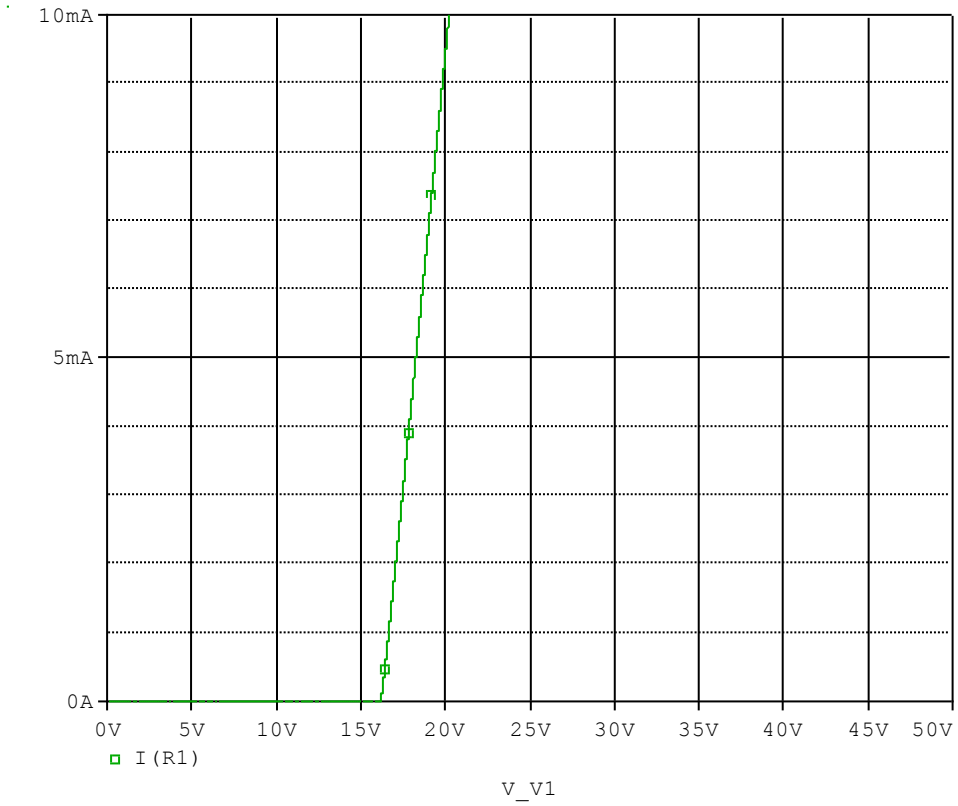
Trj=8.0(ns)
Trb=5.6(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



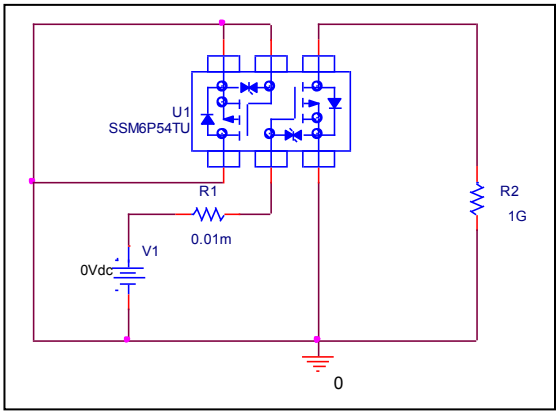
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference