Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPCA8015-H
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

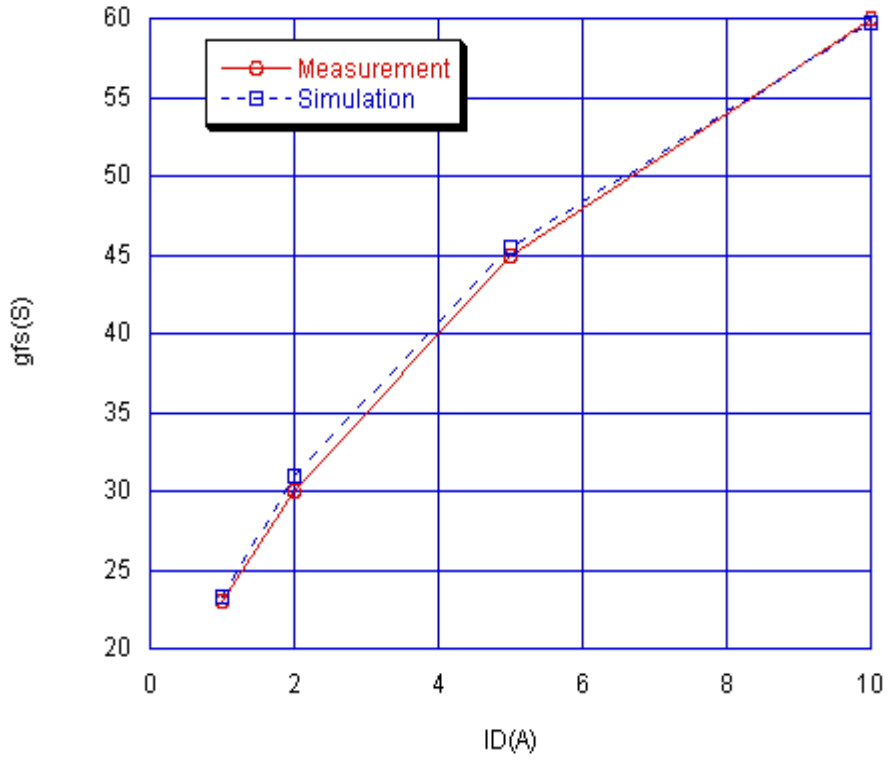
Bee Technologies Inc.

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

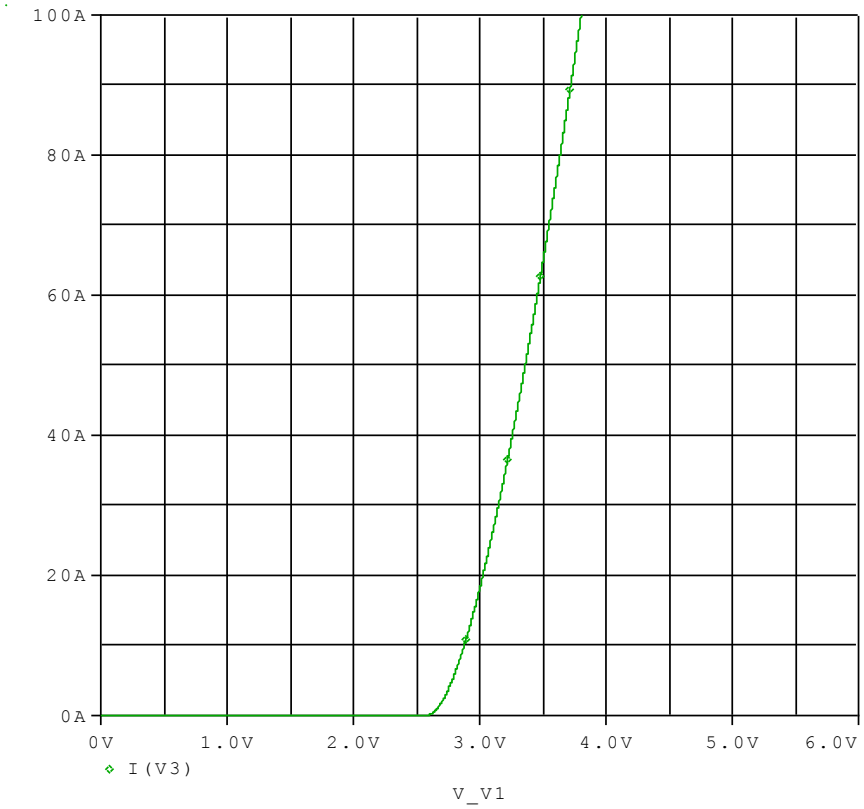


Comparison table

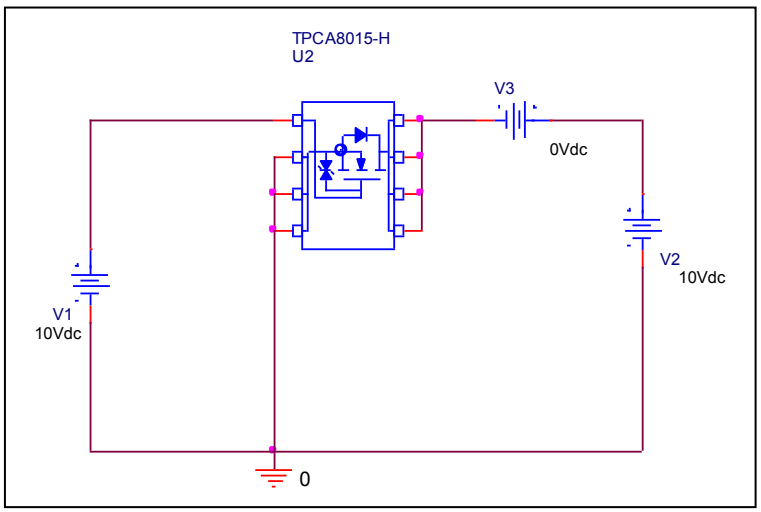
Id(A)	gfs		Error(%)
	Measurement	Simulation	
1.000	23.000	23.274	1.191
2.000	30.000	31.004	3.347
5.000	45.000	45.471	1.047
10.00	60.000	59.683	-0.528

Vgs-Id Characteristic

Circuit Simulation result

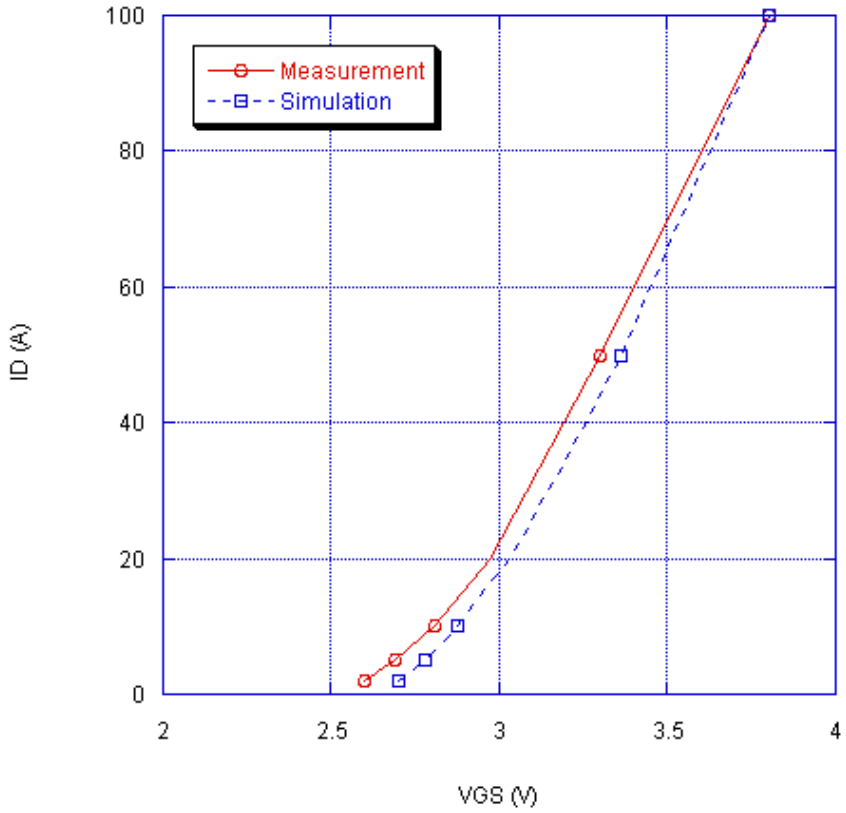


Evaluation circuit



Comparison Graph

Circuit Simulation Result

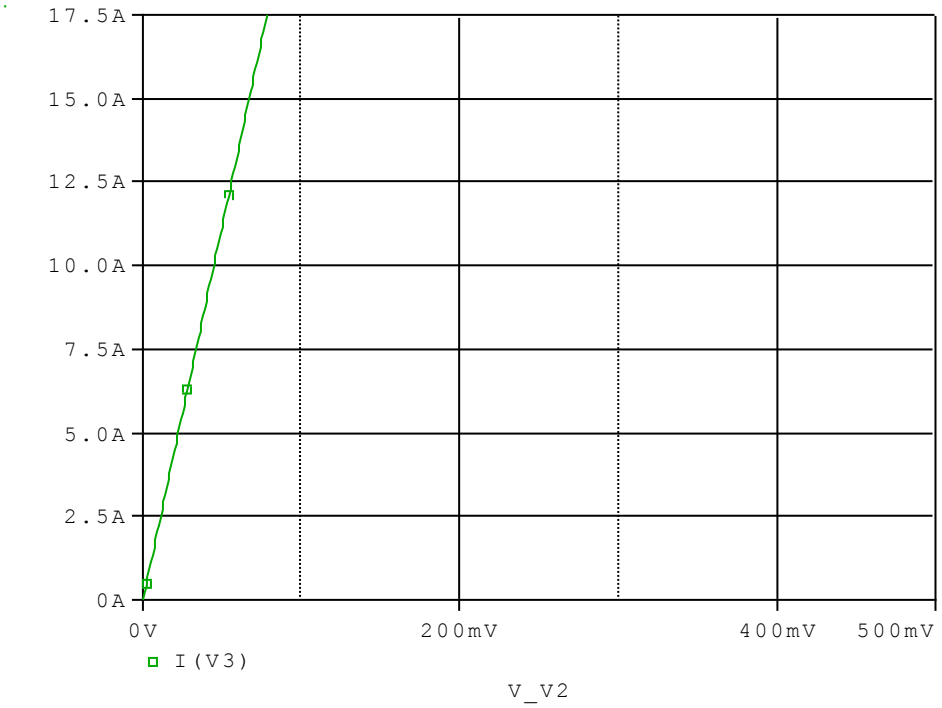


Simulation Result

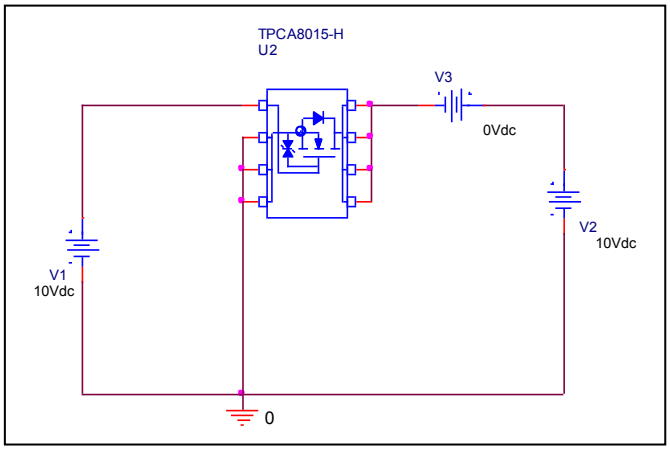
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
2.000	2.600	2.702	3.919
5.000	2.690	2.781	3.398
10.000	2.810	2.878	2.406
20.000	2.970	3.026	1.872
50.000	3.300	3.361	1.839
100.000	3.800	3.804	0.116

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

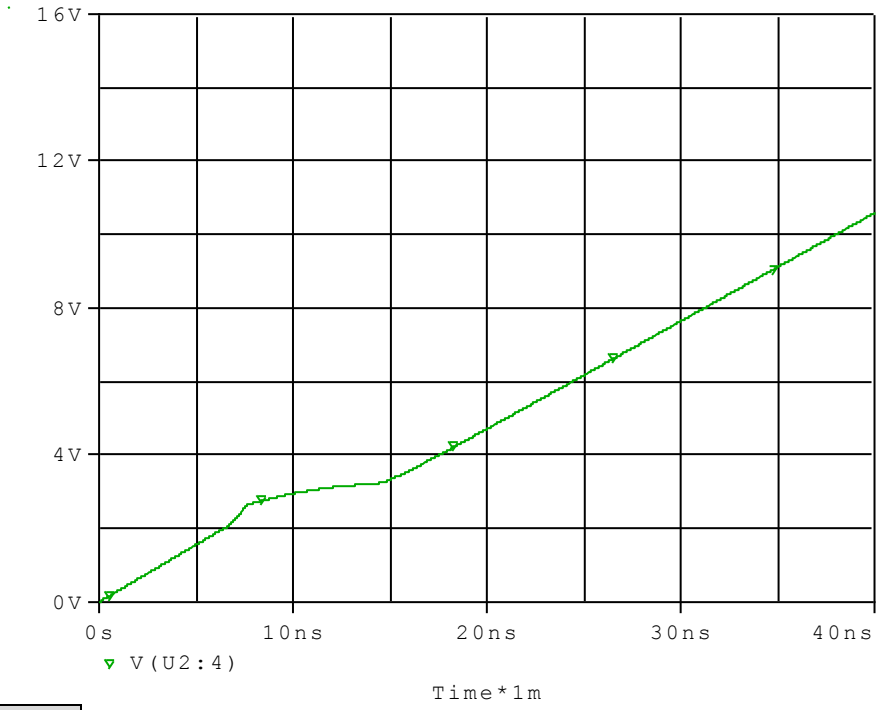


Simulation Result

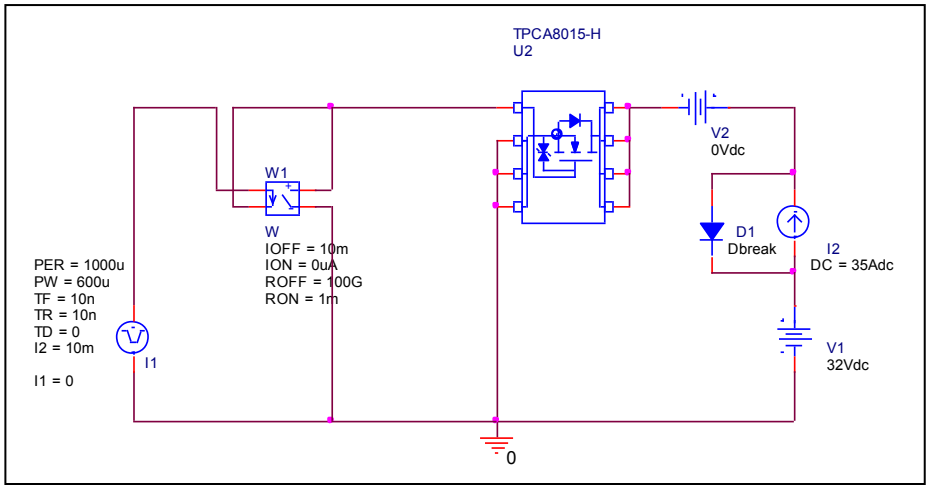
I_D=17.5A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	4.400	mΩ	4.460	mΩ	1.364

Gate Charge Characteristic

Circuit Simulation result



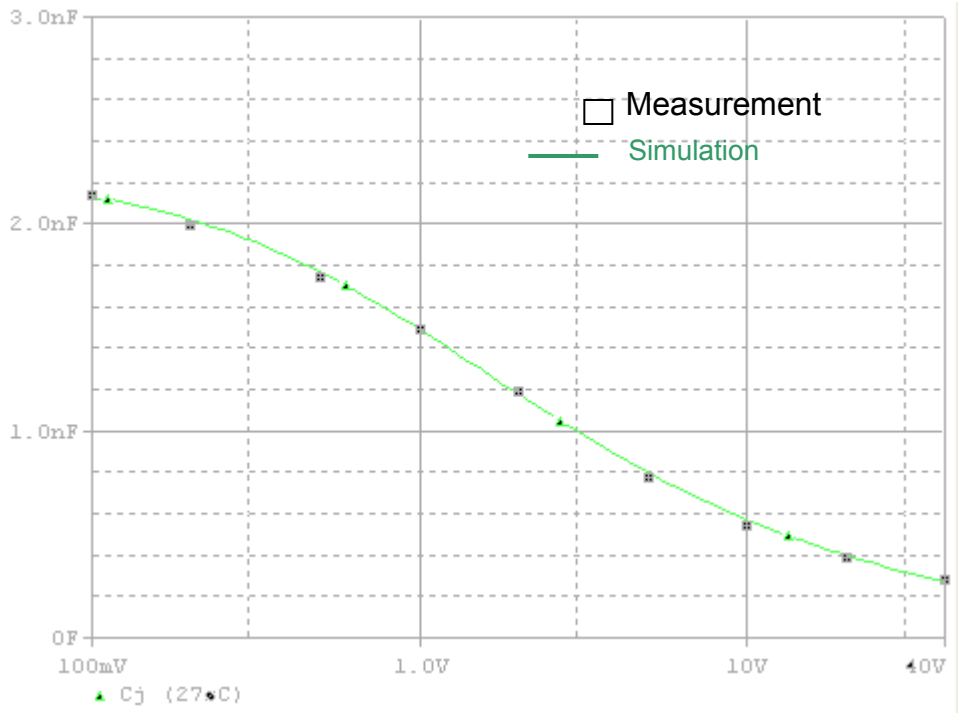
Evaluation circuit



Simulation Result

V_{DD}=32V,I_D= 35A ,V_{GS}=5V	Measurement		Simulation		Error (%)
Qgs	7.000	nC	7.288	nC	4.114
Qgd	9.000	nC	8.640	nC	4.000
Qg	21.000	nC	21.000	nC	0.000

Capacitance Characteristic

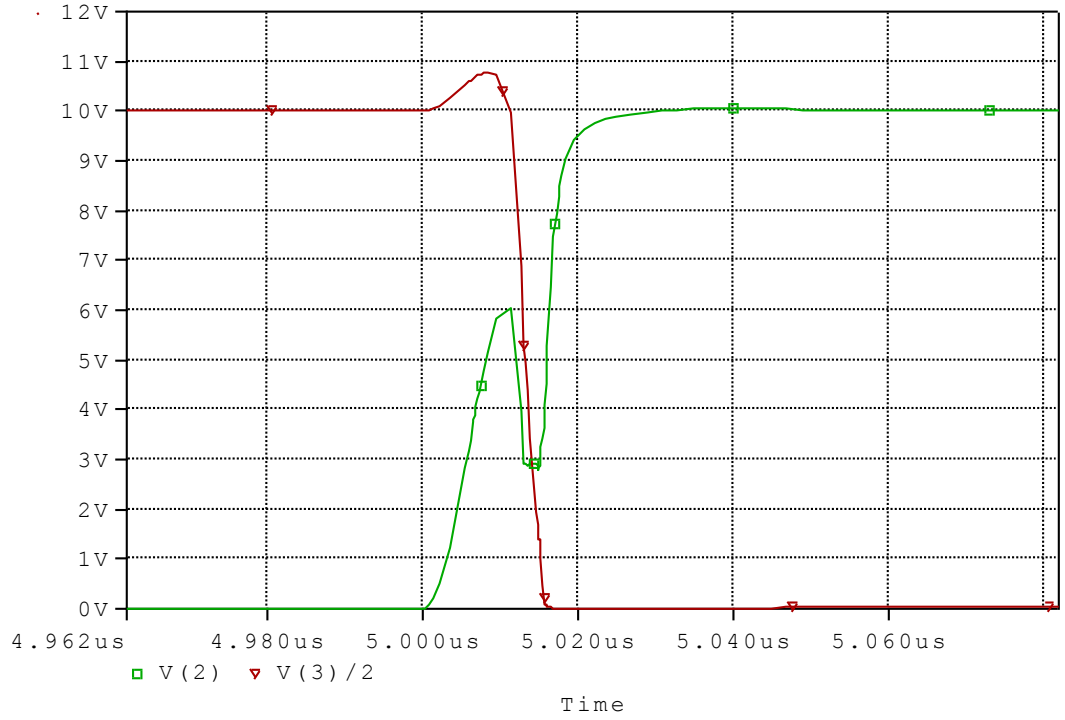


Simulation Result

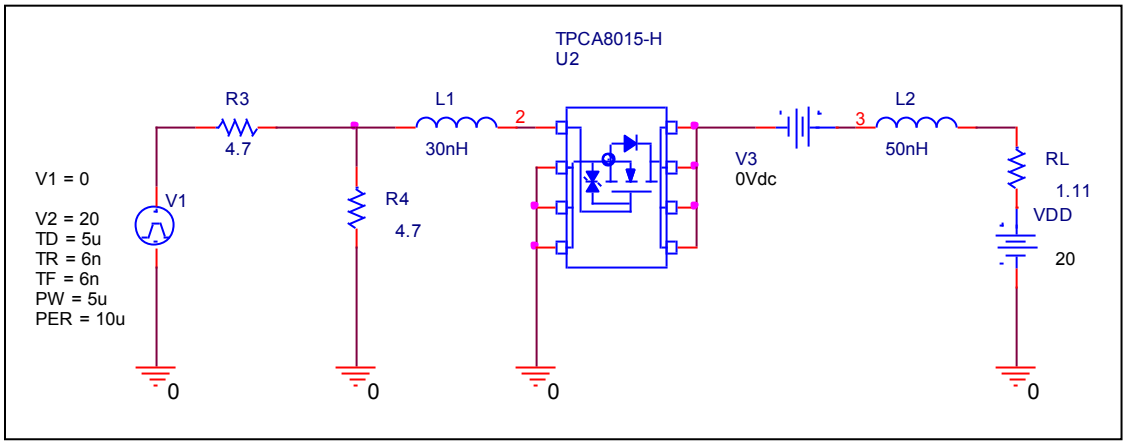
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	2120.000	2100.000	-0.943
0.200	2060.000	2000.000	-2.913
0.500	1750.000	1760.000	0.571
1.000	1500.000	1500.000	0.000
2.000	1200.000	1250.000	4.167
5.000	780.000	790.000	1.282
10.000	550.000	560.000	1.818
20.000	400.000	405.000	1.250
40.000	290.000	280.000	-3.448

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

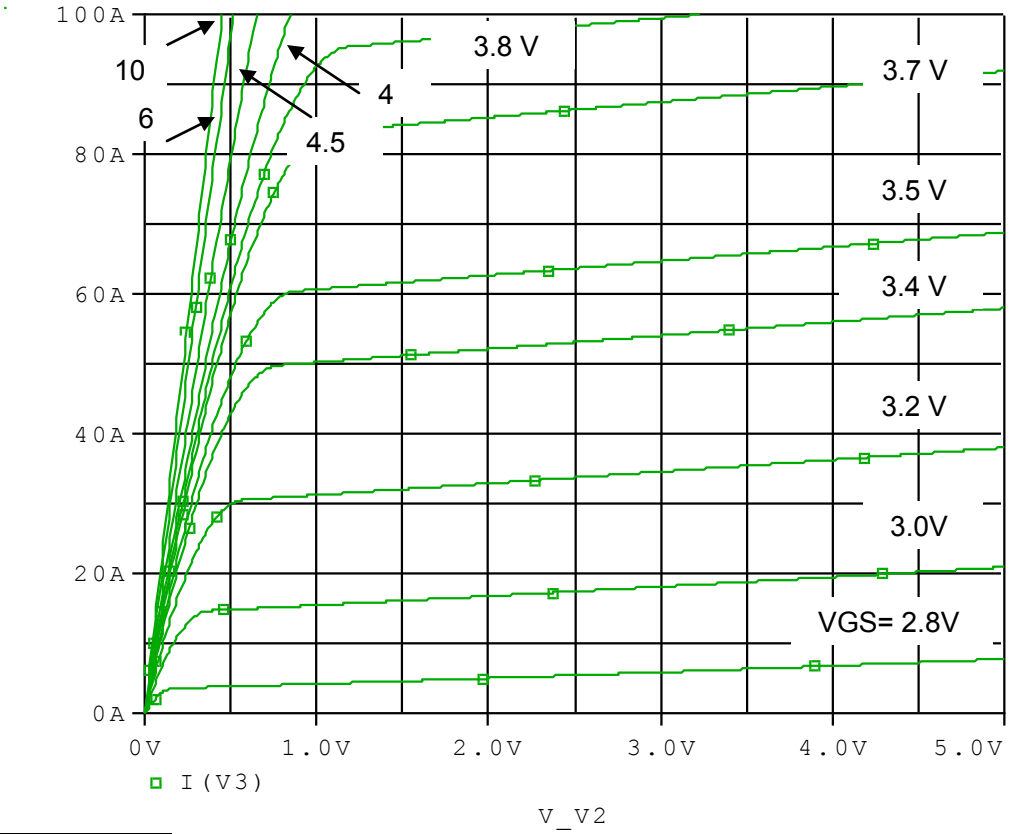


Simulation Result

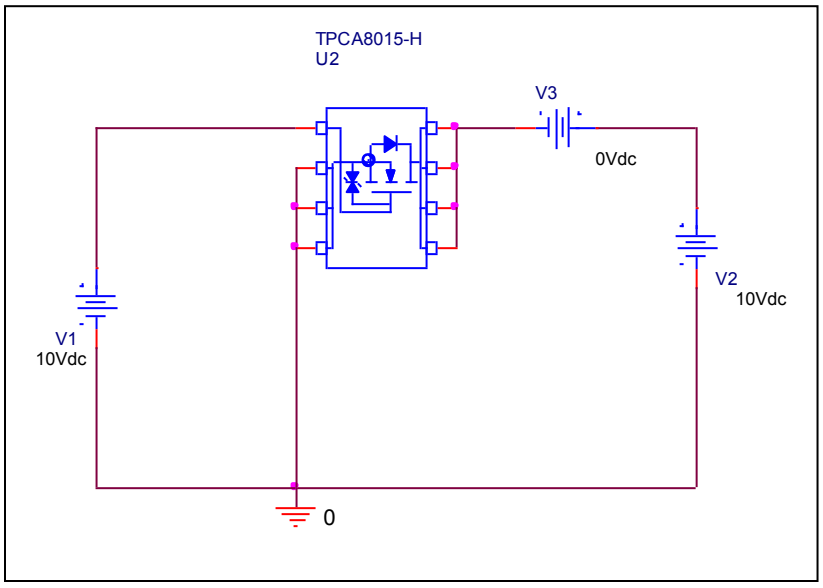
I_D=17.5A, V_{DD}= 20V V_{GS}=0/10V	Measurement		Simulation		Error(%)
ton	12.000	ns	12.010	ns	0.083

Output Characteristic

Circuit Simulation result

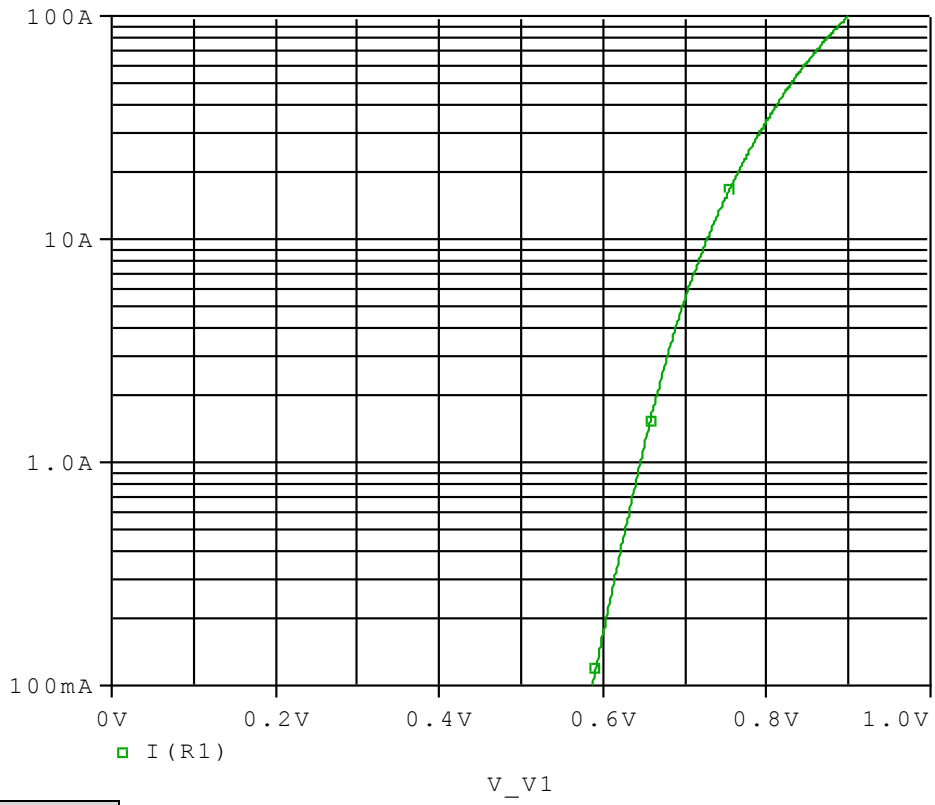


Evaluation circuit

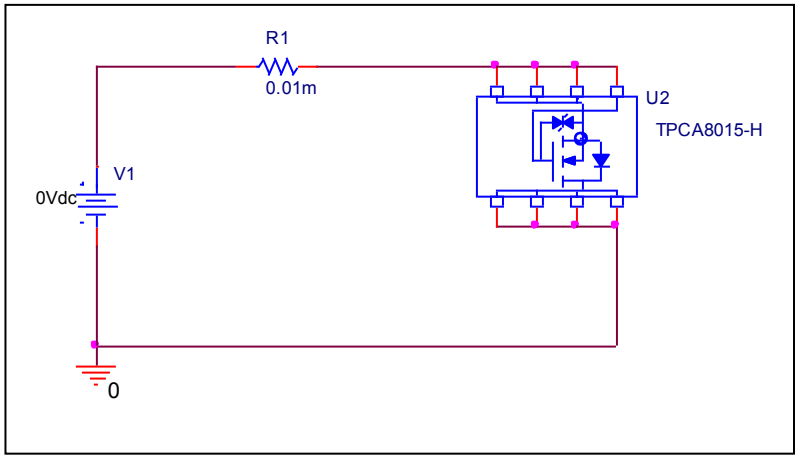


Forward Current Characteristic

Circuit Simulation Result

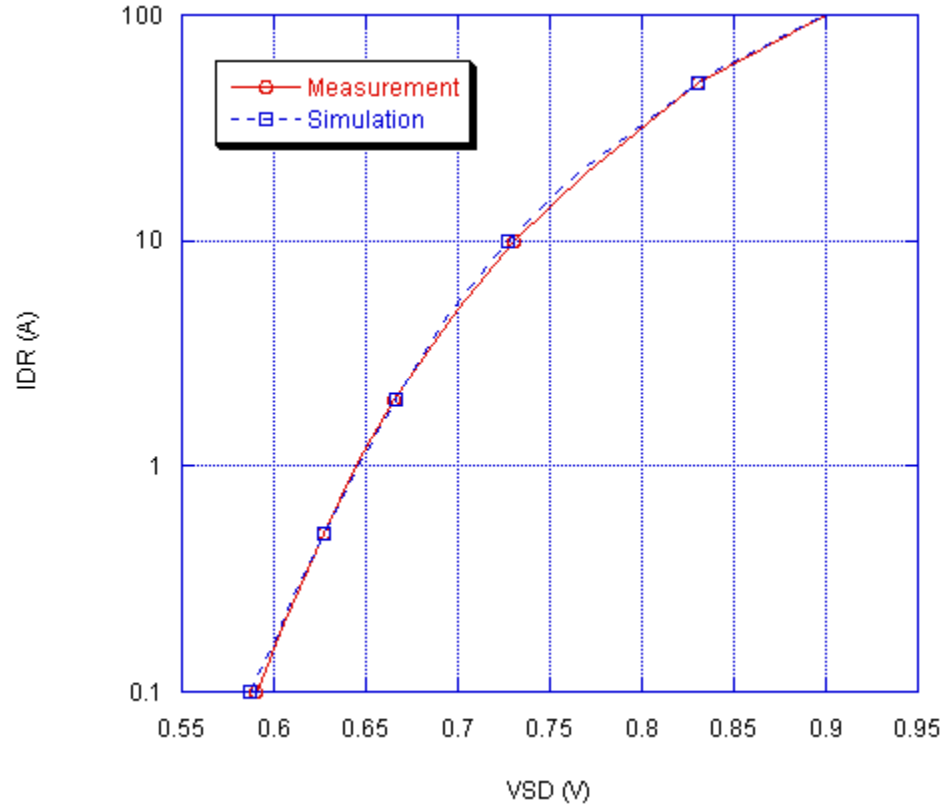


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

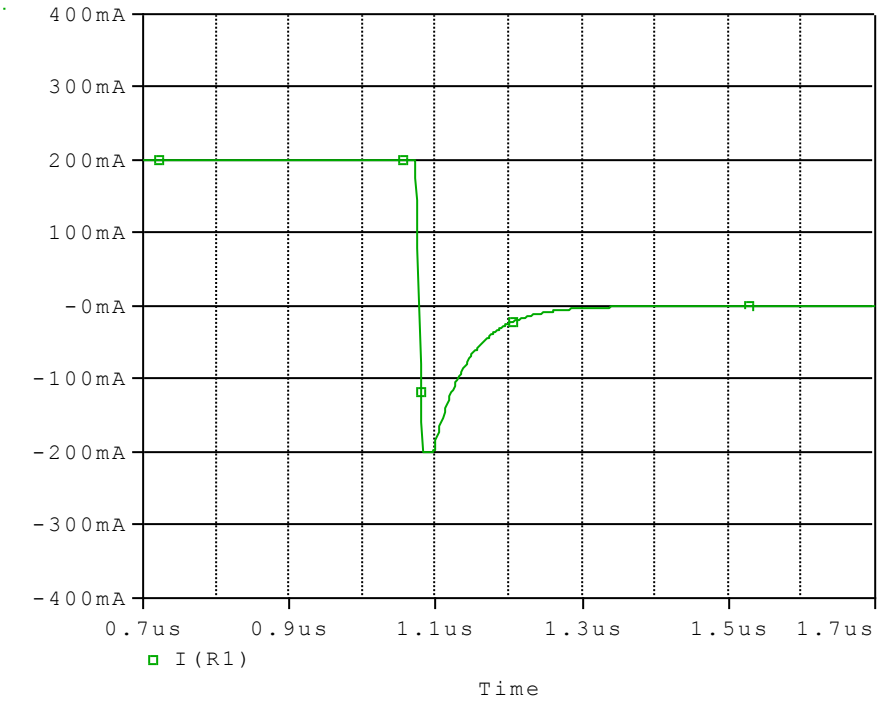


Simulation Result

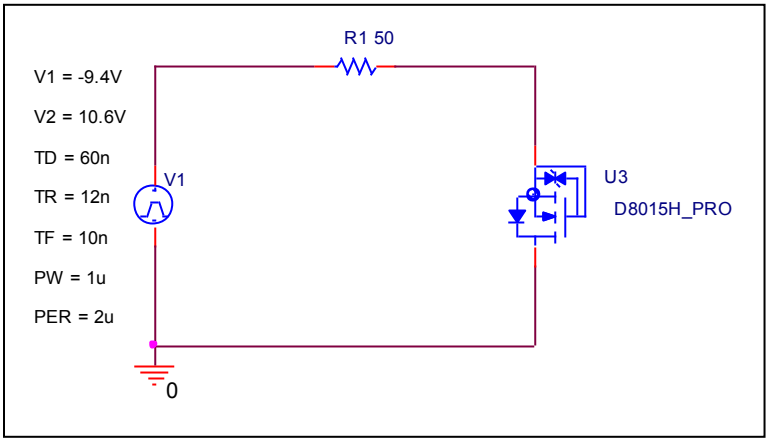
IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
0.100	0.590	0.587	-0.508
0.200	0.605	0.604	-0.165
0.500	0.627	0.627	0.000
1.000	0.645	0.646	0.155
2.000	0.665	0.666	0.150
5.000	0.700	0.697	-0.429
10.000	0.730	0.727	-0.411
20.000	0.770	0.765	-0.649
50.000	0.830	0.830	0.000
100.000	0.900	0.900	0.000

Reverse Recovery Characteristic

Circuit Simulation Result



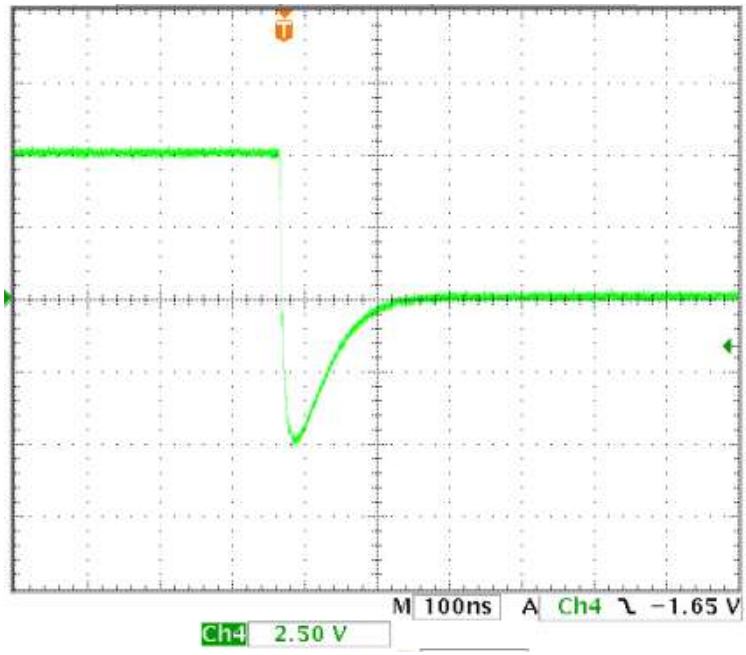
Evaluation Circuit



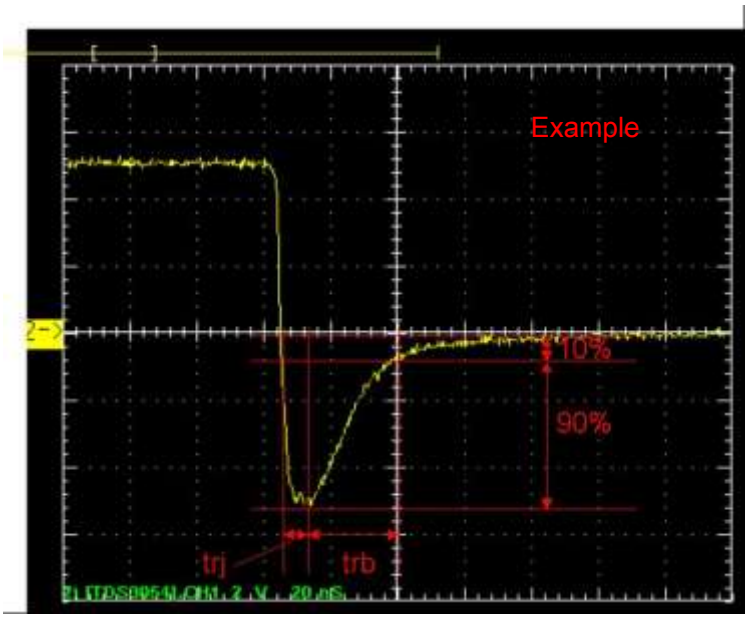
Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	18.000	ns	17.934	ns	-0.367
trb	112.000	ns	111.494	ns	-0.452
trr	130.000	ns	129.428	ns	-0.440

Reverse Recovery Characteristic Reference



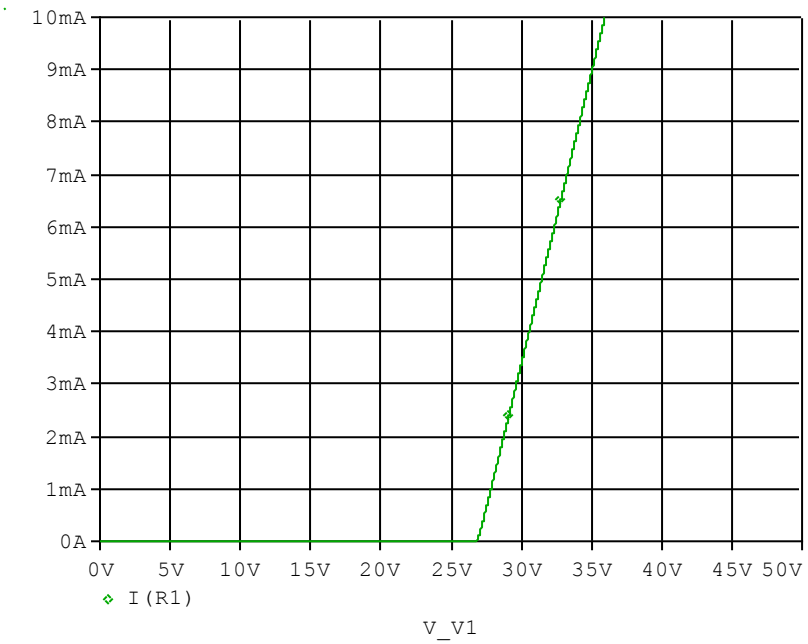
Trj=18 (ns)
Trb=112(ns)
Conditions:Ifwd=Irev=0.2(A),Rl=50



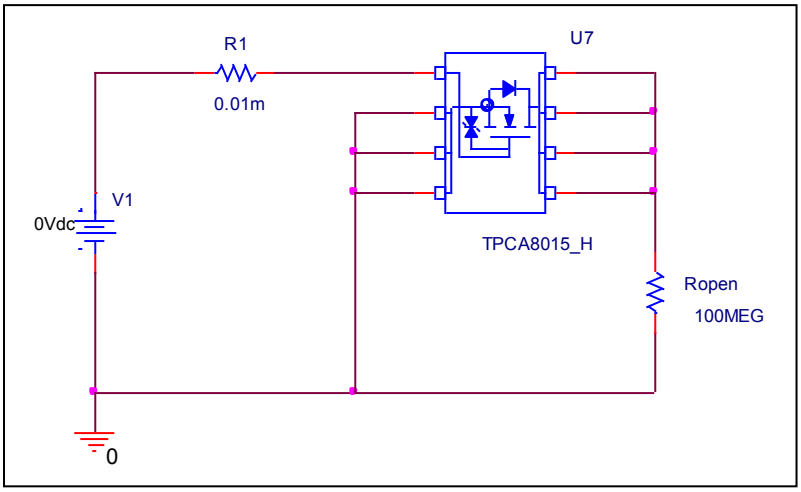
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic Reference