

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPC8018-H
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

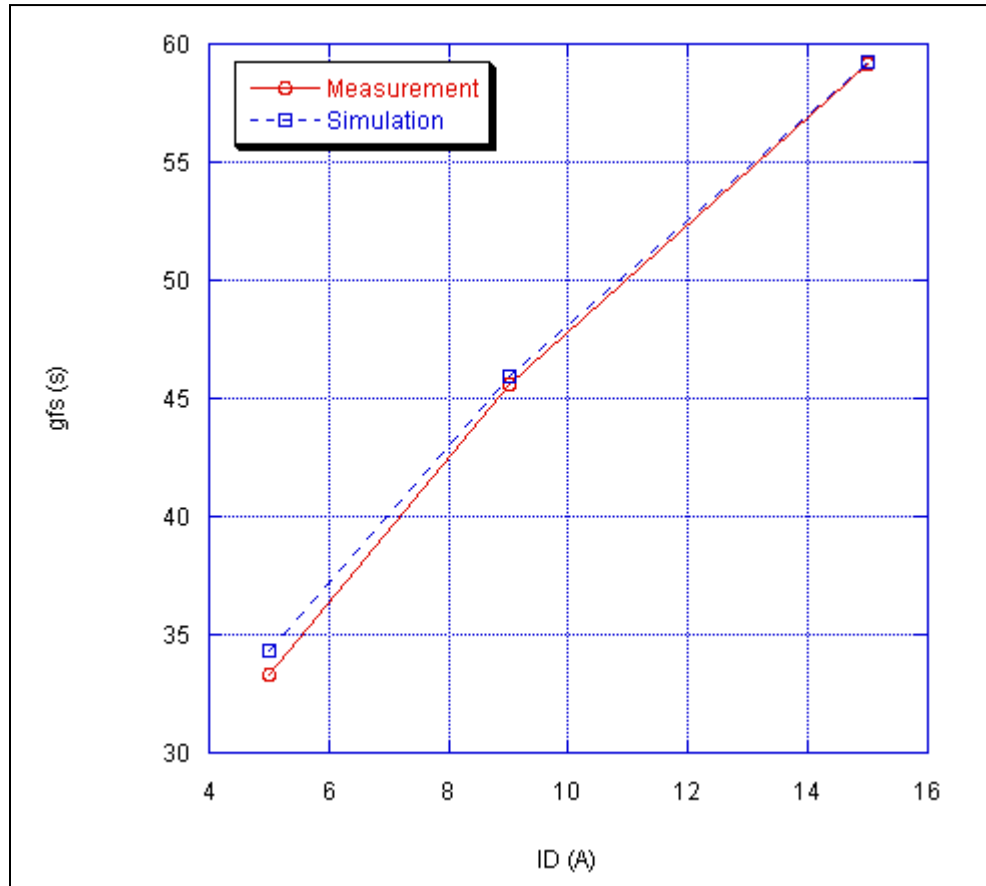


MOSFET MODEL

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

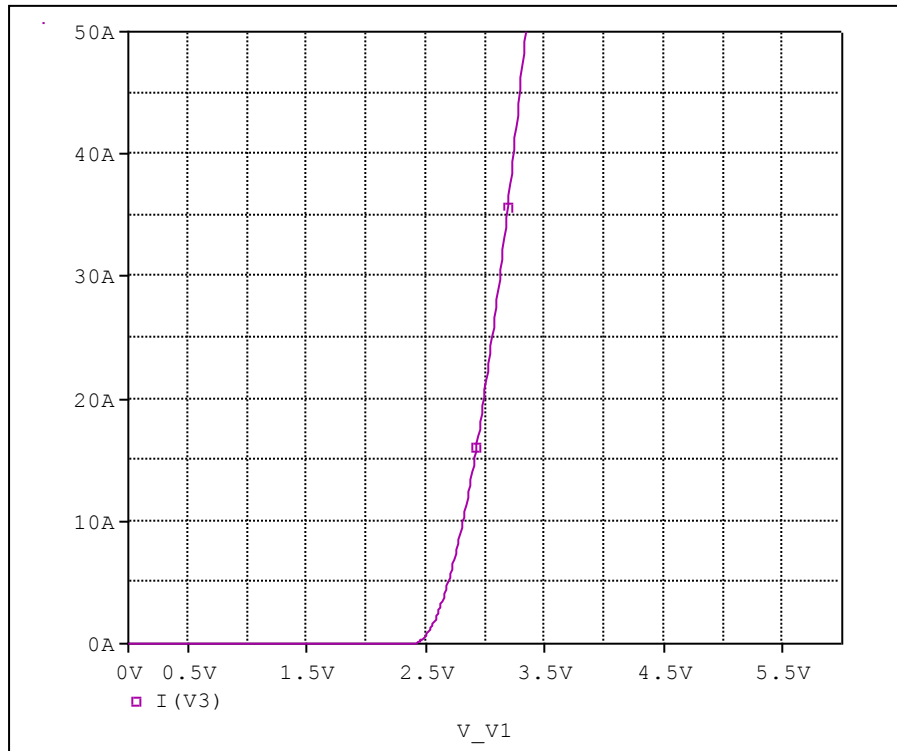


Comparison table

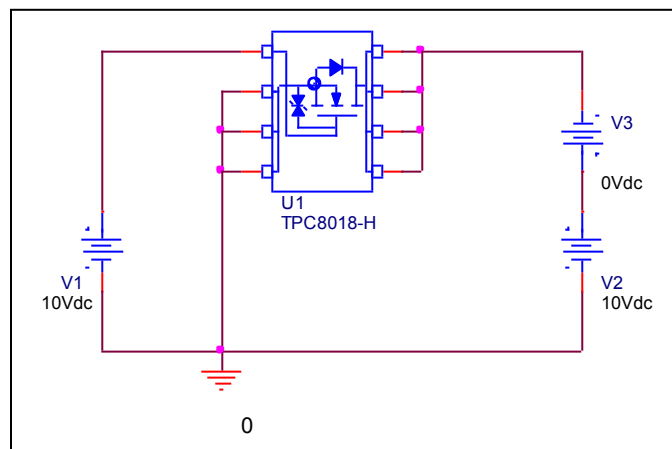
Id(A)	gfs		Error(%)
	Measurement	Simulation	
5.00	33.33	34.31	2.94
9.00	45.57	45.92	0.77
15.00	59.17	59.21	0.07

V_{gs}-I_d Characteristic

Circuit Simulation result

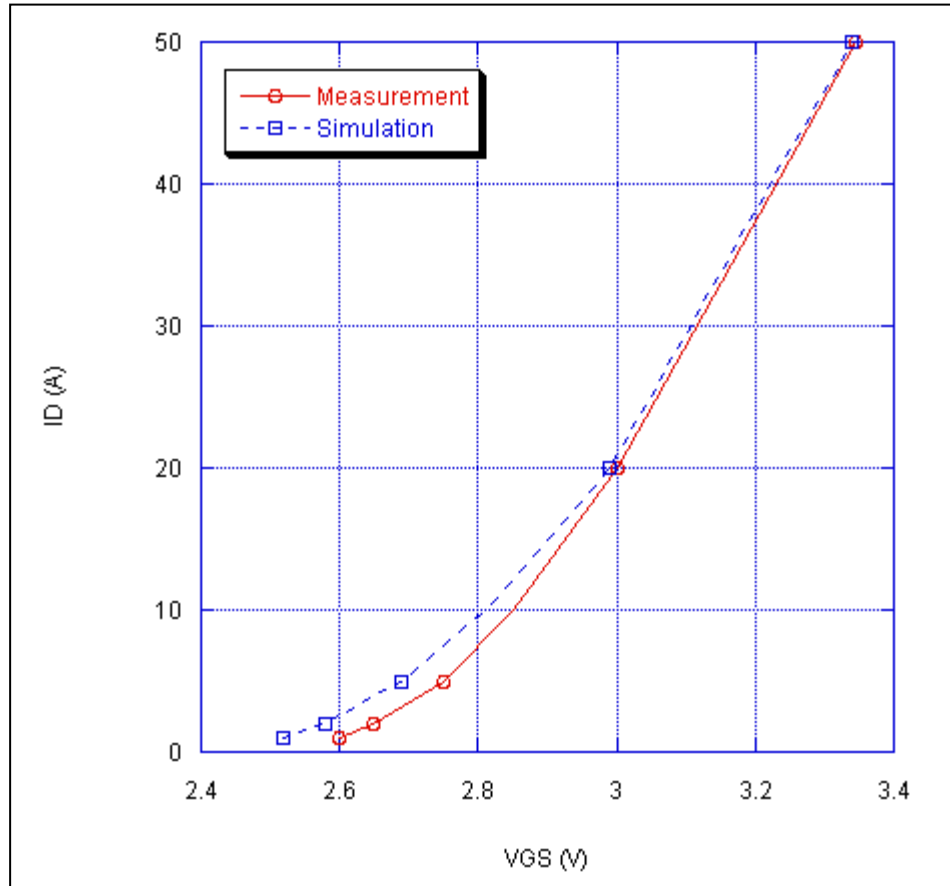


Evaluation circuit



Comparison Graph

Circuit Simulation Result

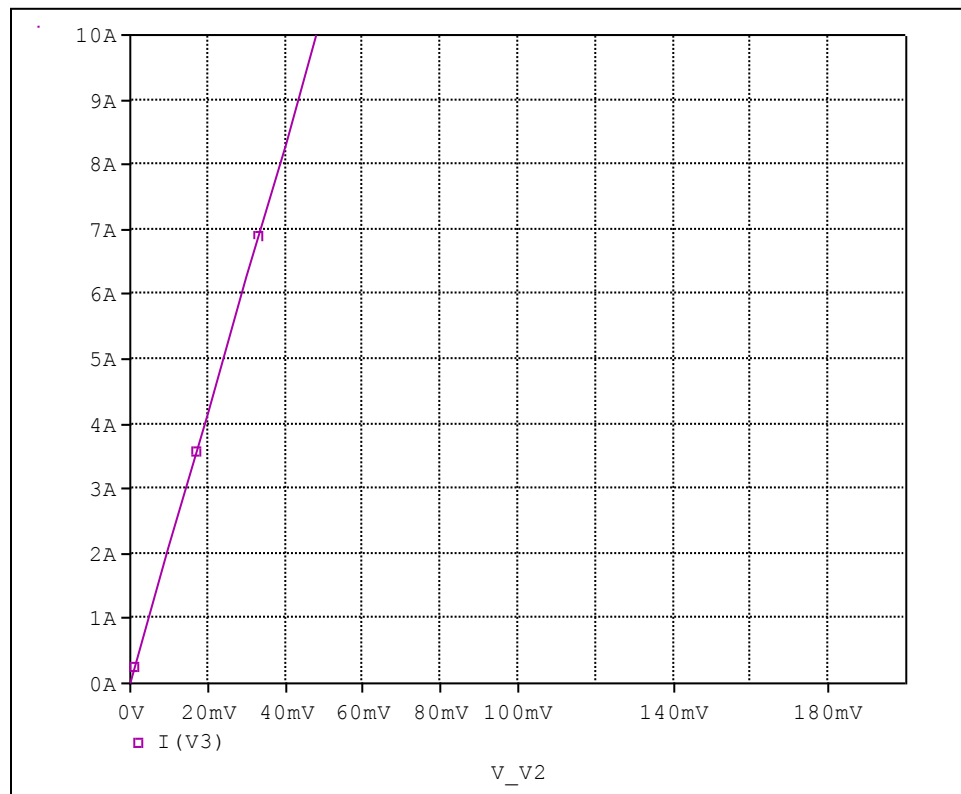


Simulation Result

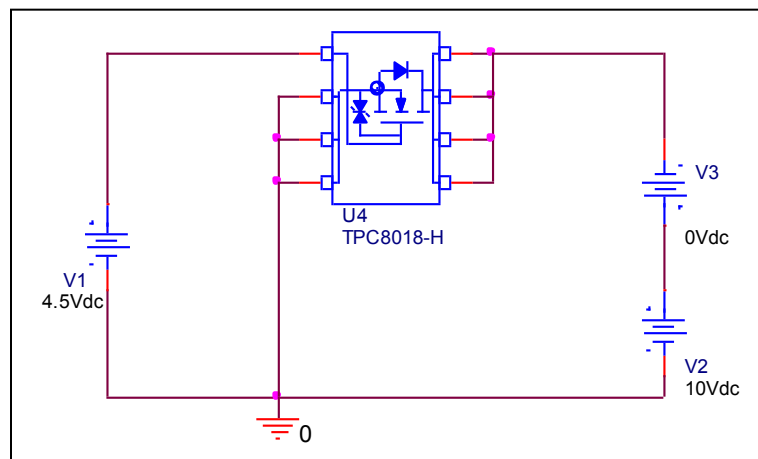
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
1.00	2.60	2.52	-3.08
2.00	2.65	2.58	-2.64
5.00	2.75	2.69	-2.18
10.00	2.85	2.81	-1.40
20.00	3.00	2.99	-0.33
50.00	3.35	3.34	-0.15

Id-Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

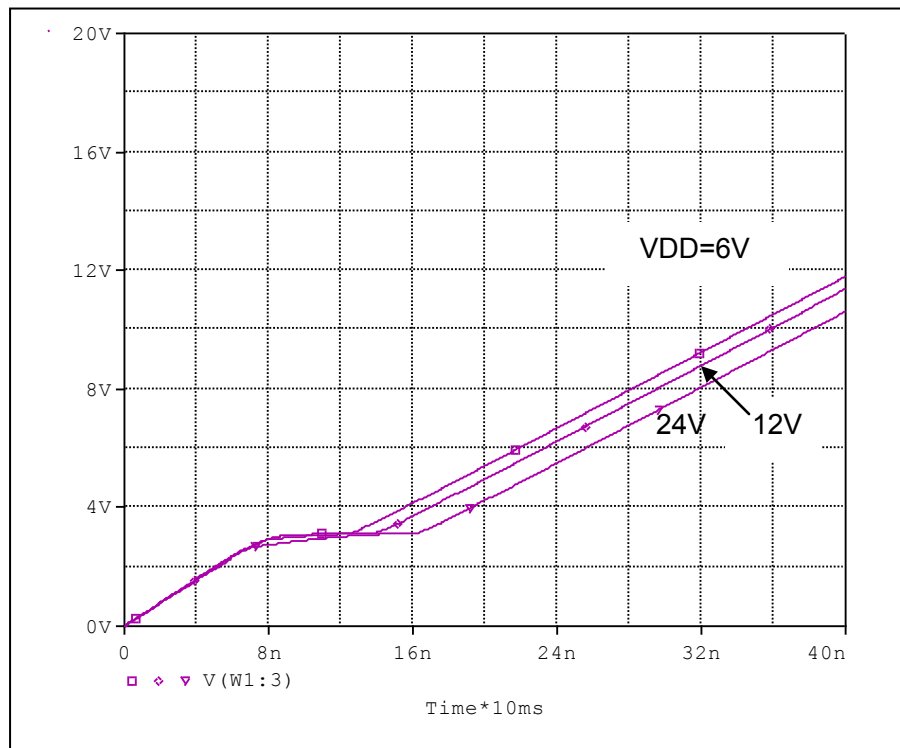


Simulation Result

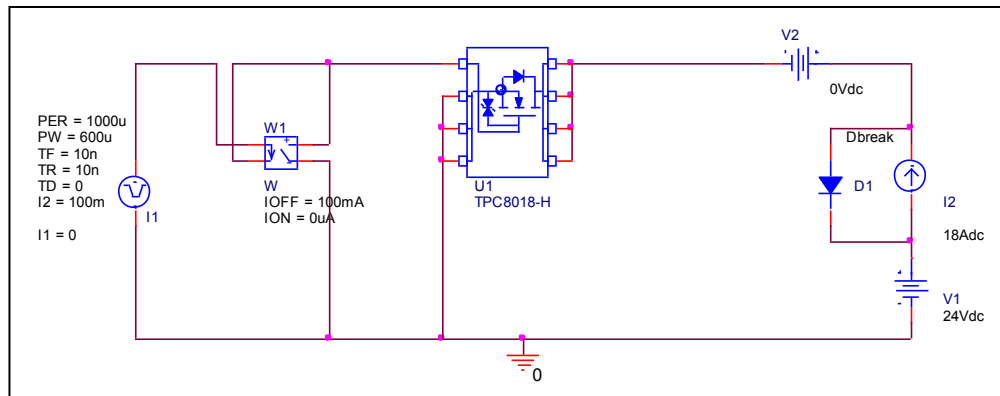
$I_D=9.0A$, $V_{GS}=4.5V$	Measurement		Simulation		Error (%)
$R_{DS(on)}$	4.800	mΩ	4.805	mΩ	0.104

Gate Charge Characteristic

Circuit Simulation result



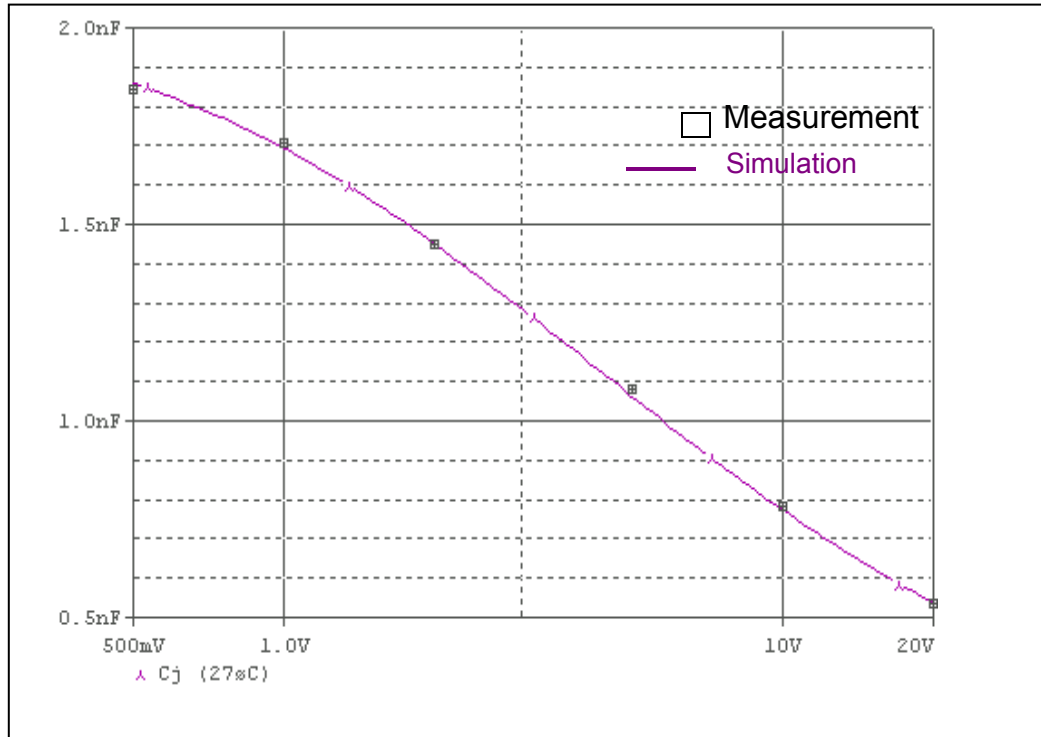
Evaluation circuit



Simulation Result

$V_{DD}=16V, I_D=3A$ $V_{GS}=10V$	Measurement		Simulation		Error (%)
Qgs	7.30	nC	7.30	nC	0.00
Qgd	9.00	nC	9.01	nC	0.11
Qg	38.00	nC	38.03	nC	0.08

Capacitance Characteristic

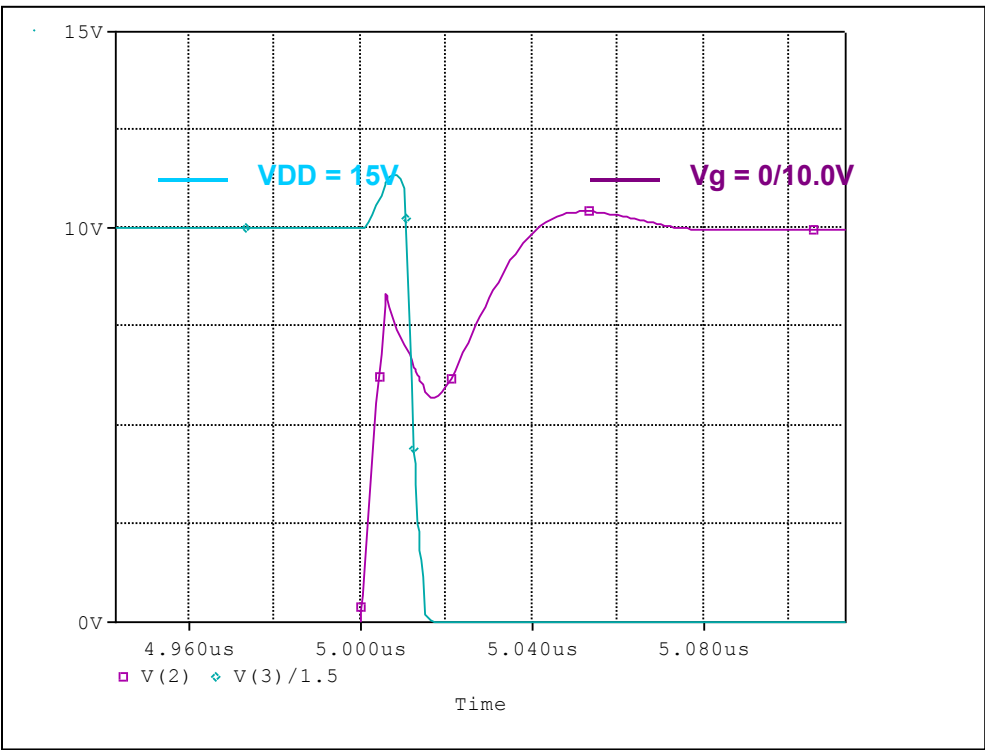


Simulation Result

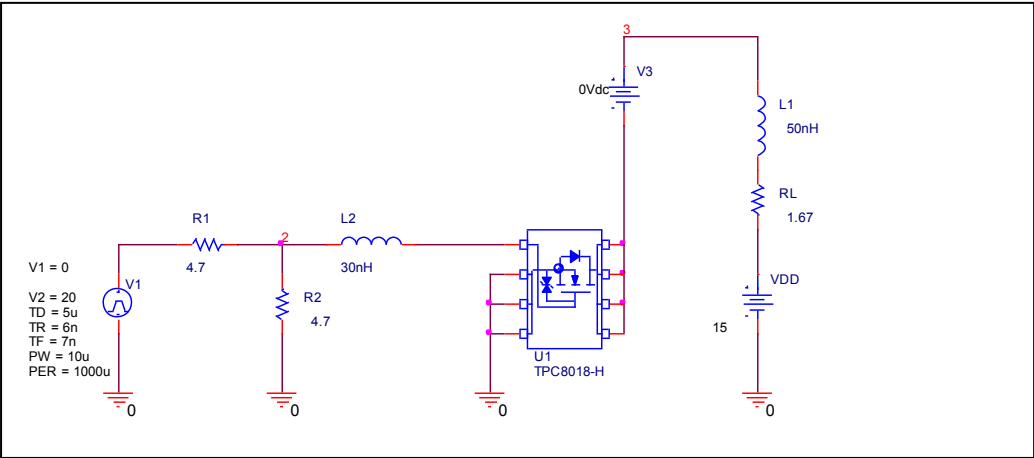
V _{DS} (V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.50	1850.00	1859.00	0.49
1.00	1710.00	1693.00	-0.99
2.00	1455.00	1453.00	-0.14
5.00	1085.00	1060.00	-2.30
10.00	790.00	775.00	-1.90
20.00	540.00	535.00	-0.93

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

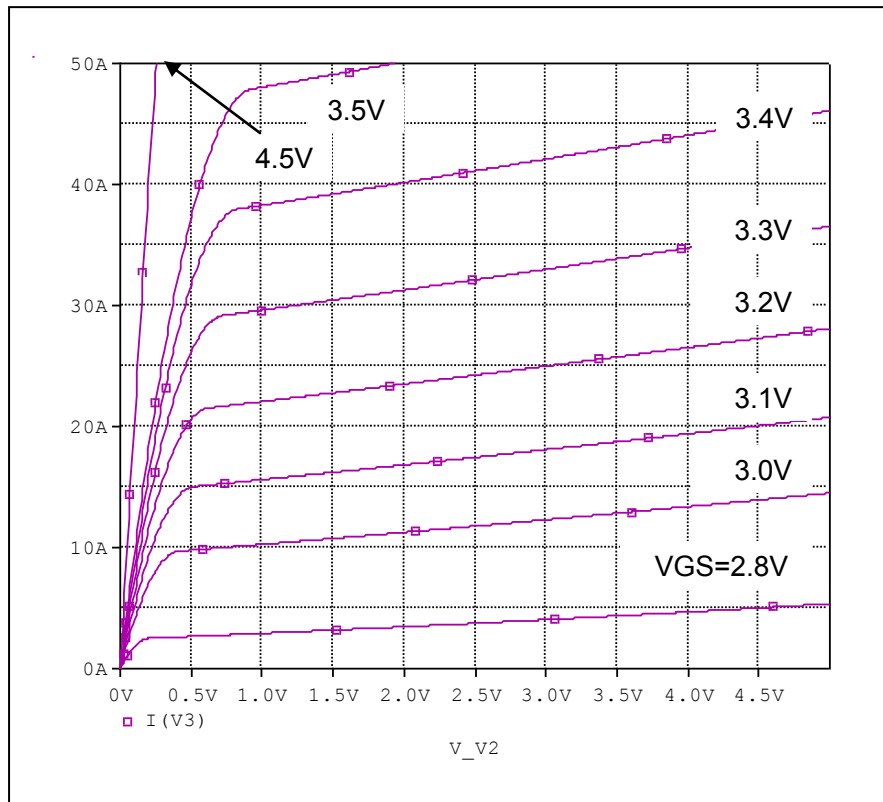


Simulation Result

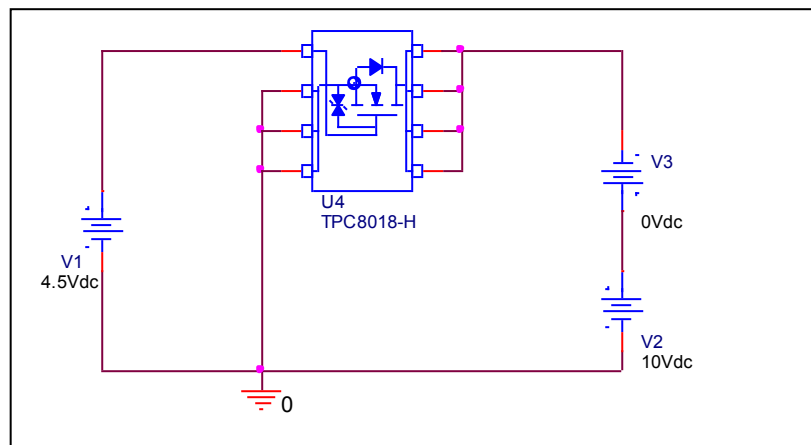
$I_D=9\text{ A}$, $V_{DD}=15\text{ V}$ $V_{GS}=0/10\text{ V}$	Measurement		Simulation		Error(%)
	ton	ns	13.98	ns	
					0.00

Output Characteristic

Circuit Simulation result

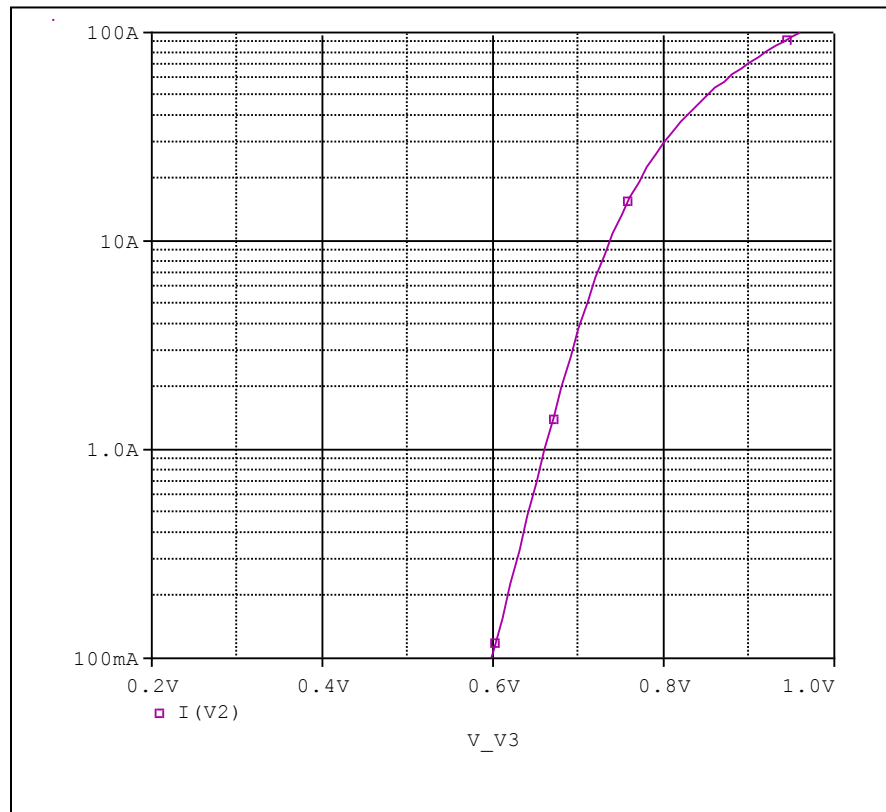


Evaluation circuit

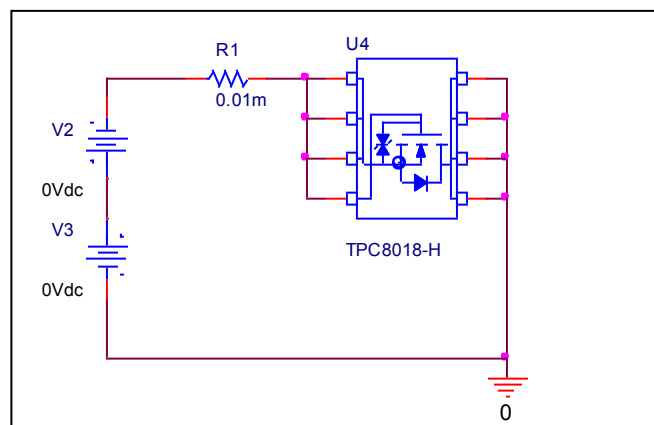


Forward Current Characteristic

Circuit Simulation Result

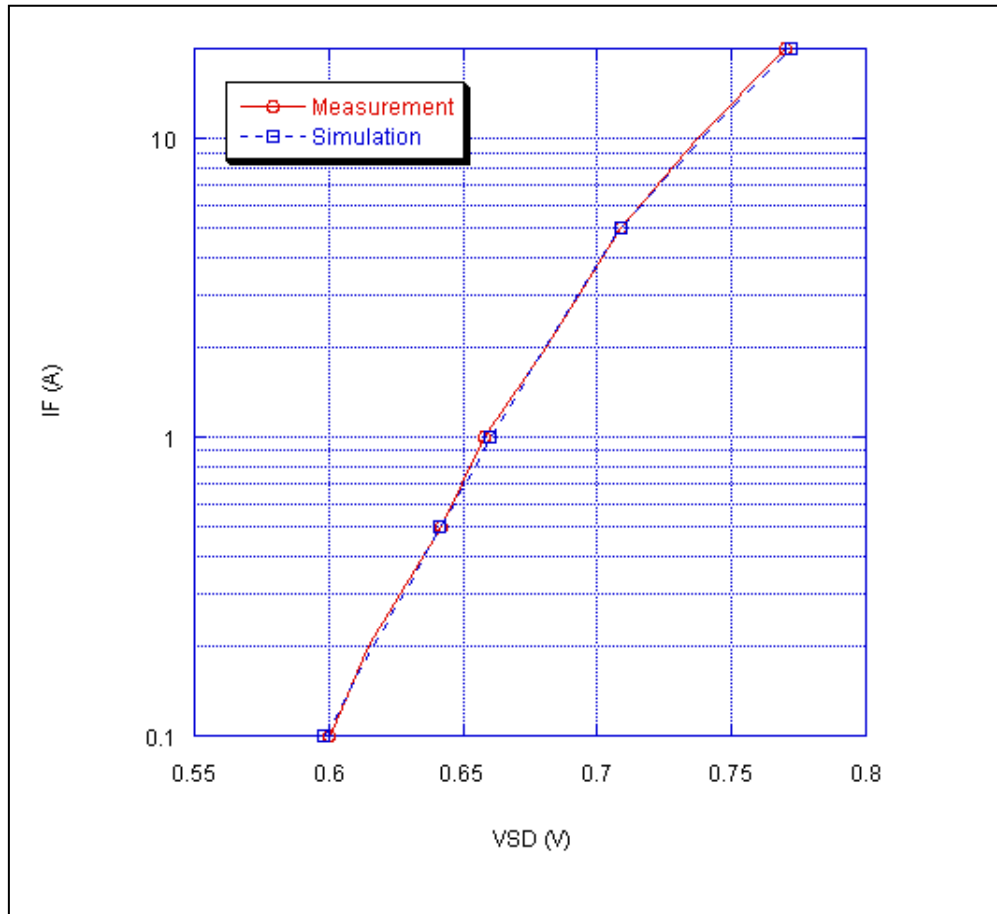


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

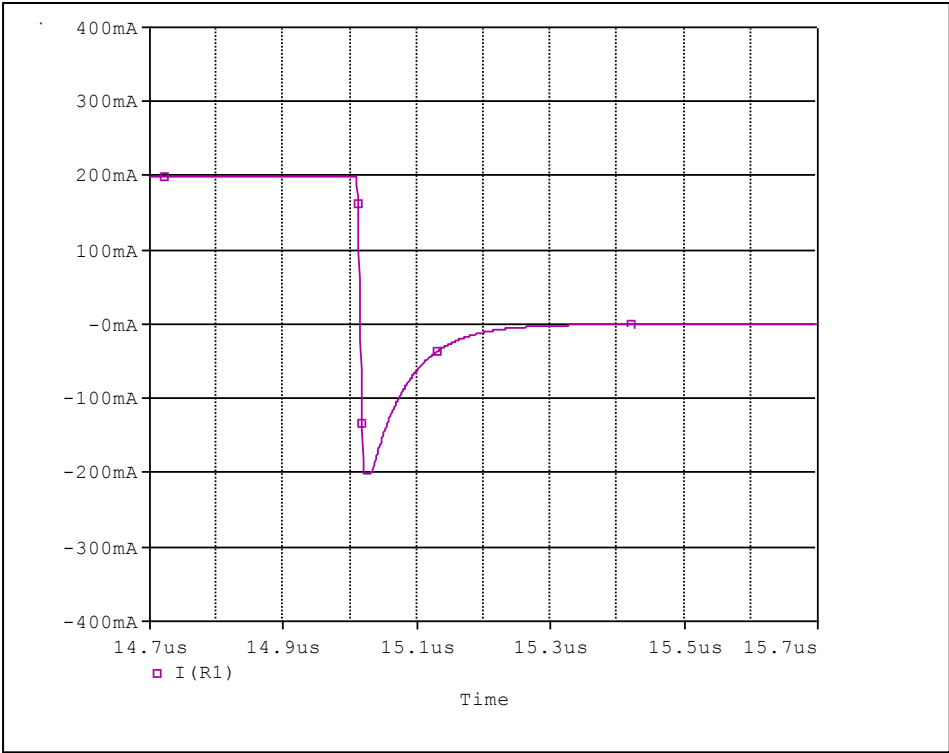


Simulation Result

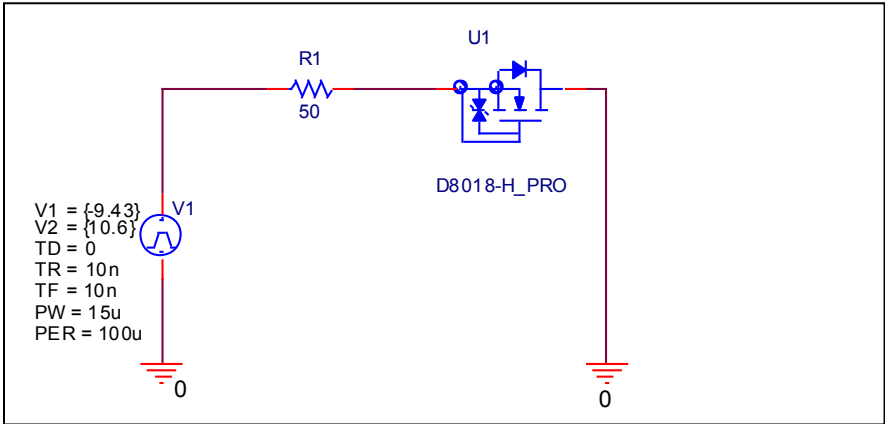
Ifwd(A)	Vfwd(V) Measurement	Vfwd(V) Simulation	%Error
0.100	0.600	0.598	-0.333
0.200	0.615	0.616	0.163
0.500	0.642	0.641	-0.156
1.000	0.658	0.660	0.304
2.000	0.681	0.680	-0.147
5.000	0.709	0.709	0.000
10.000	0.737	0.739	0.271
20.000	0.770	0.772	0.260

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

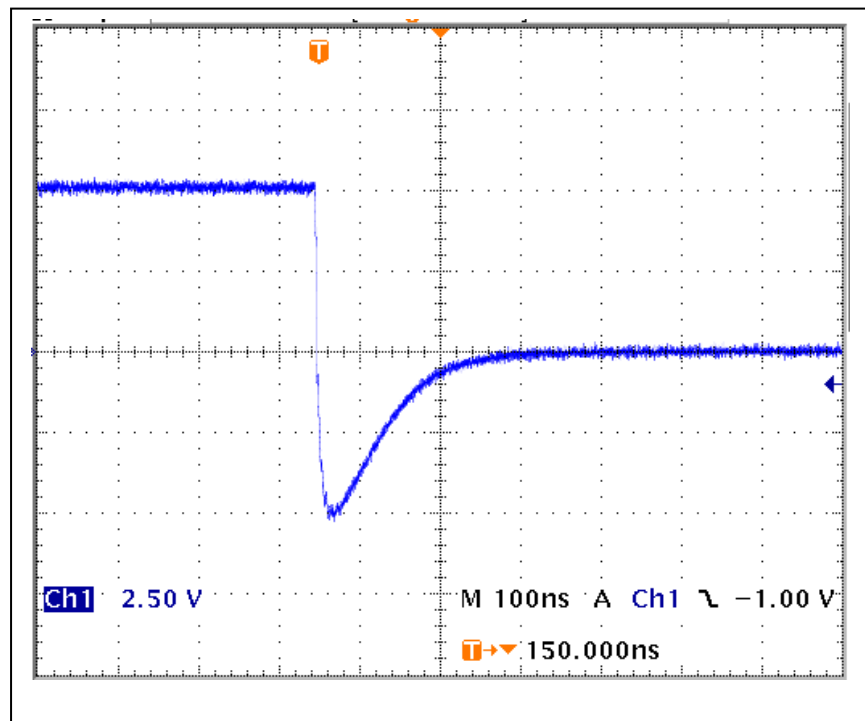


Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trj	18.00	ns	17.77	ns	-1.278
trb	134.00	ns	134.01	ns	0.007
trr=trj+trb	152.00	ns	151.78	ns	-0.145

Reverse Recovery Characteristic

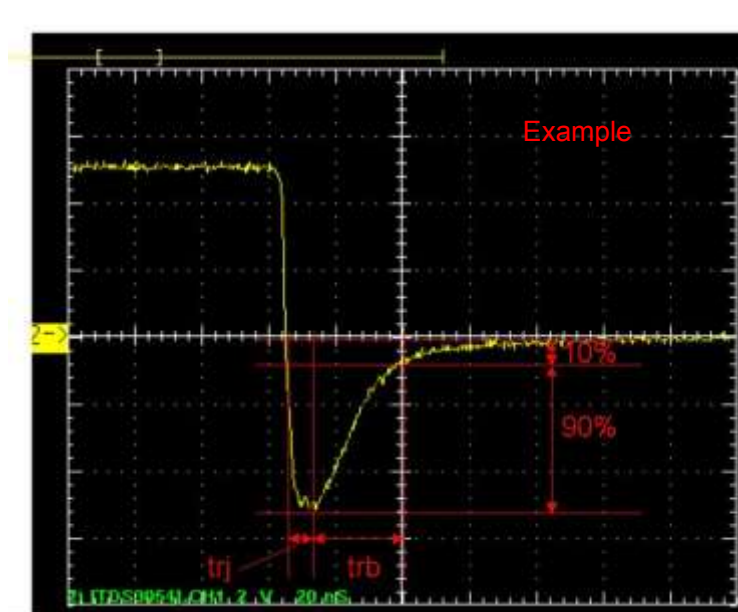
Reference



$Trj=18.00(ns)$

$Trb=134.00(ns)$

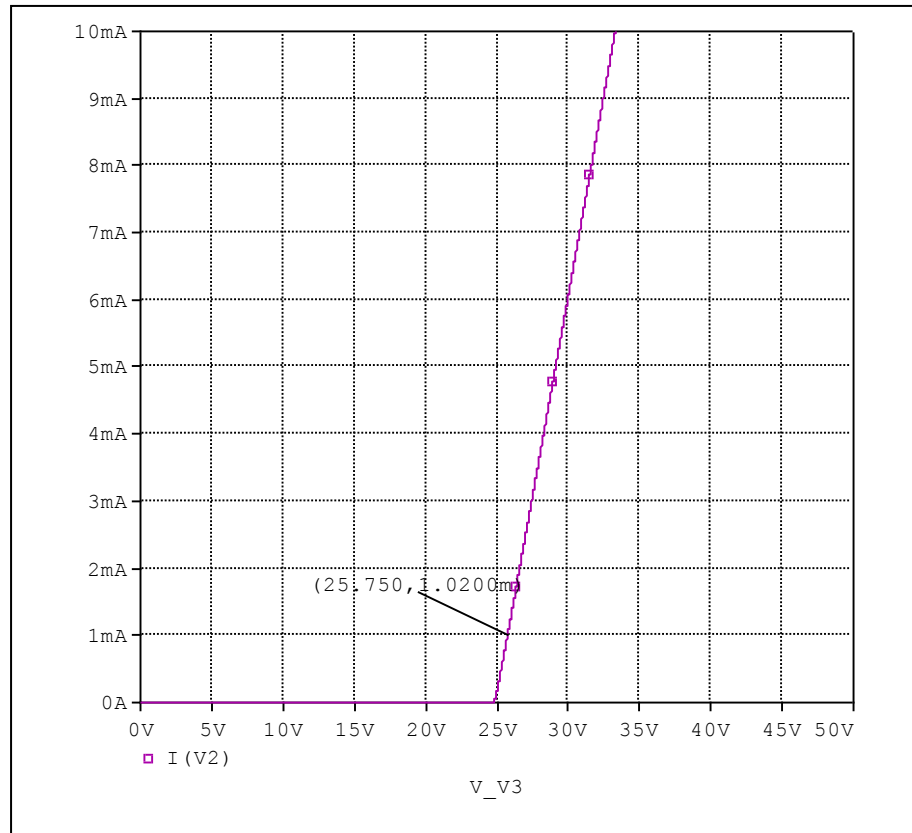
Conditions: $I_{fwd}=I_{rev}=0.2(A)$, $RI=50$



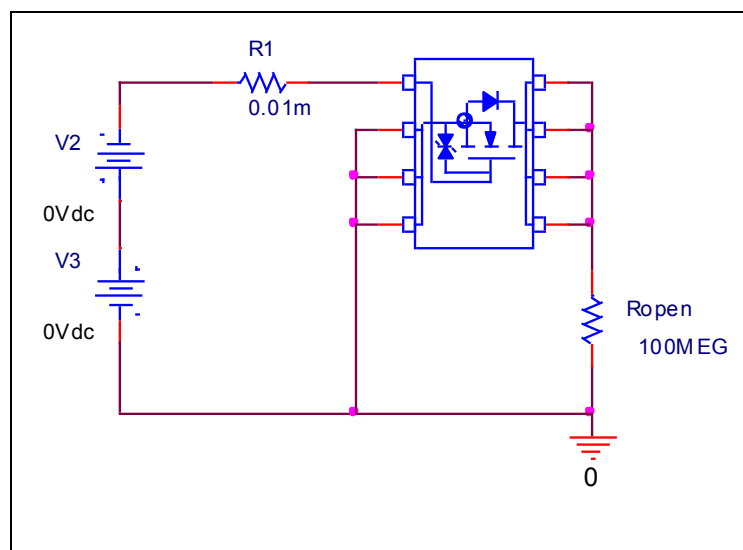
Relation between trj and trb

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic

Reference

