

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPCM8003-H
MANUFACTURER: TOSHIBA
Body Diode (Professional)



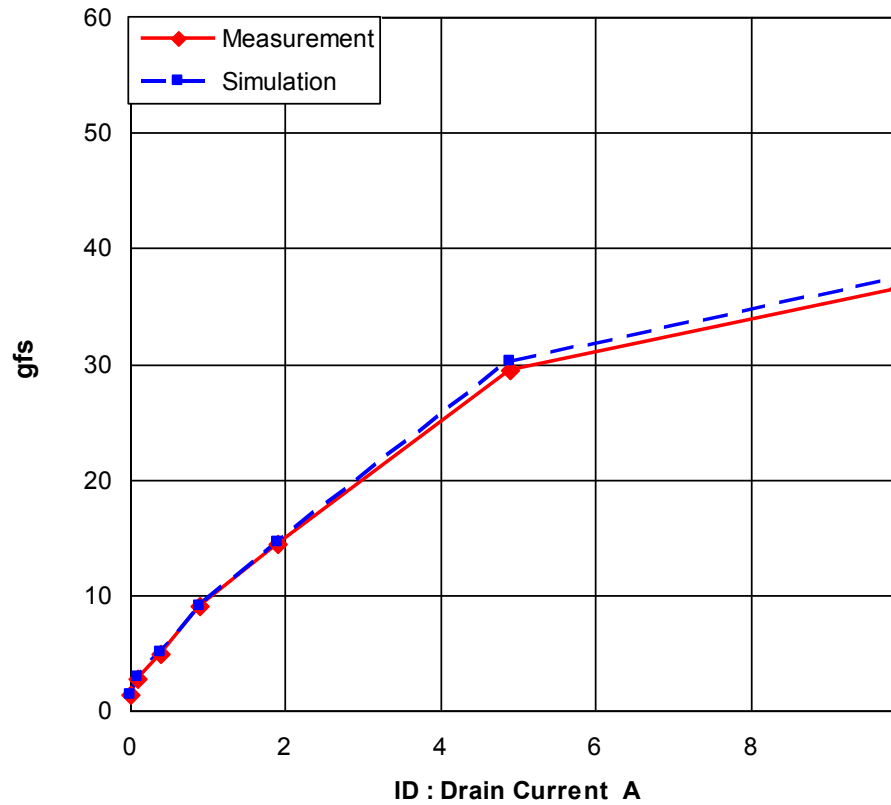
Bee Technologies Inc.

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

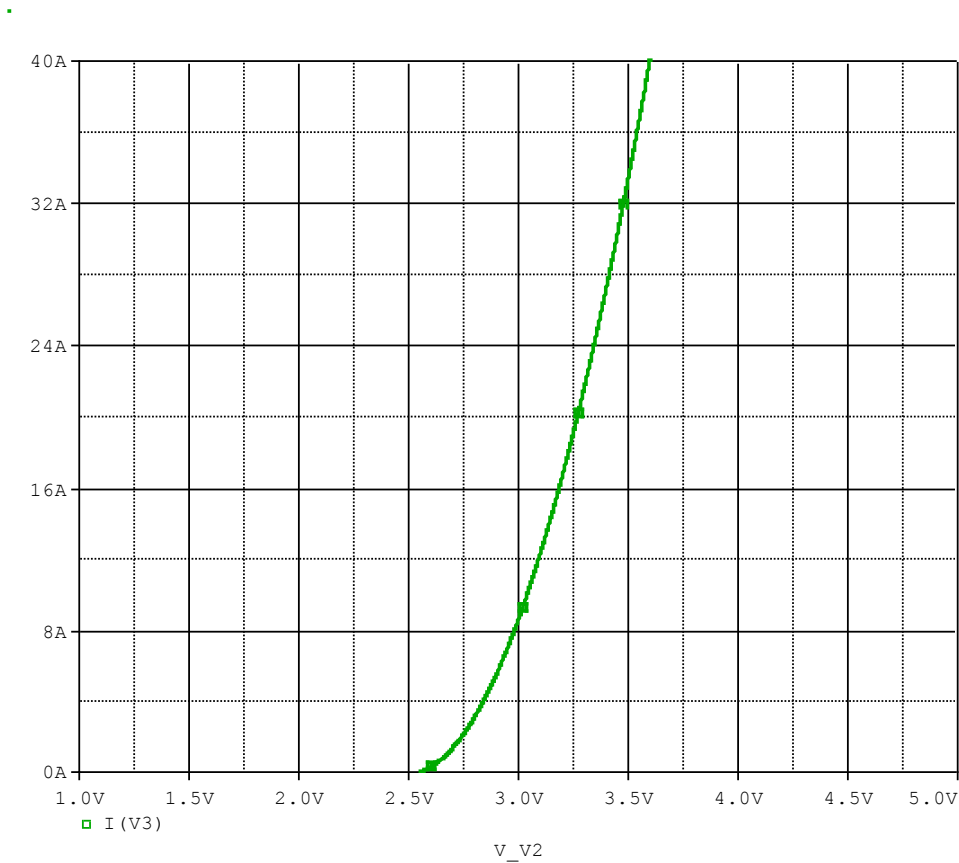


Comparison table

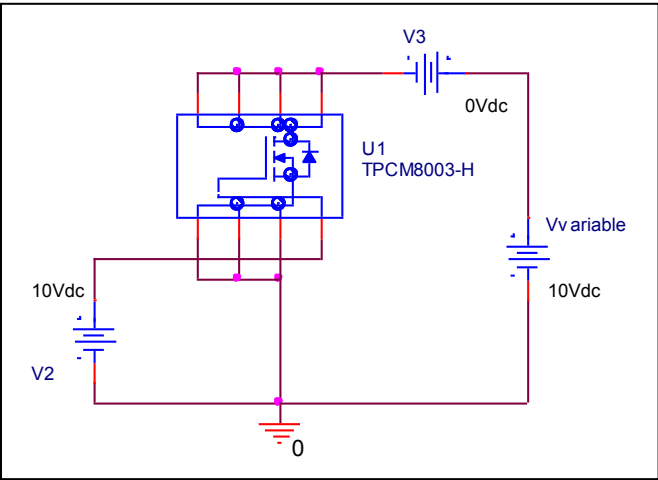
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.100	1.450	1.448	-0.138
0.200	2.800	2.878	2.786
0.500	4.850	5.000	3.093
1.000	9.000	9.091	1.011
2.000	14.500	14.605	0.724
5.000	29.500	30.258	2.569
10.000	36.500	37.453	2.611

Vgs-Id Characteristic

Circuit Simulation result

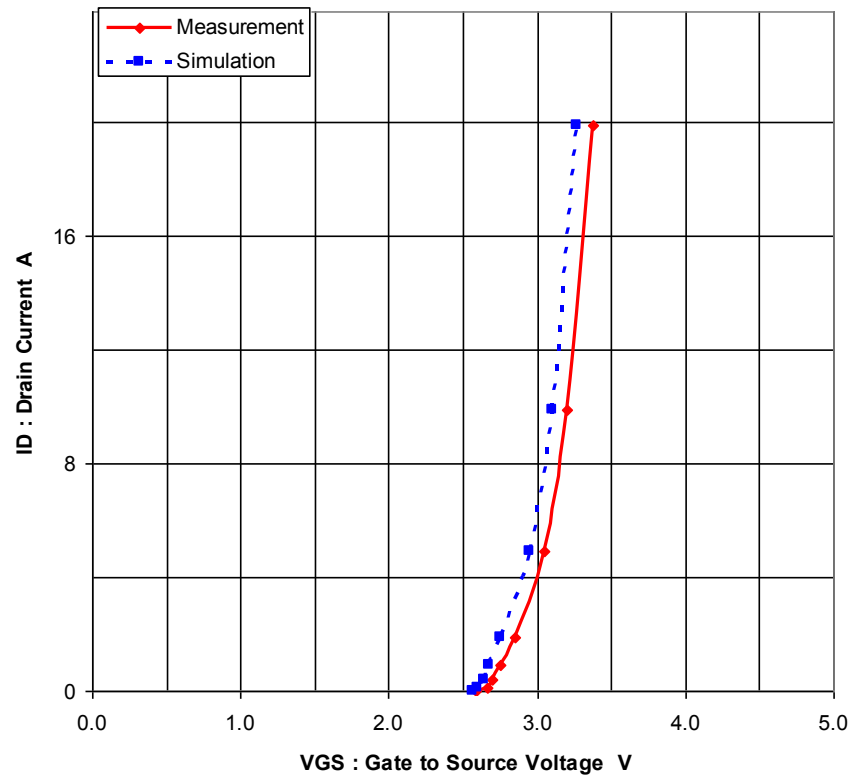


Evaluation circuit



Comparison Graph

Circuit Simulation Result

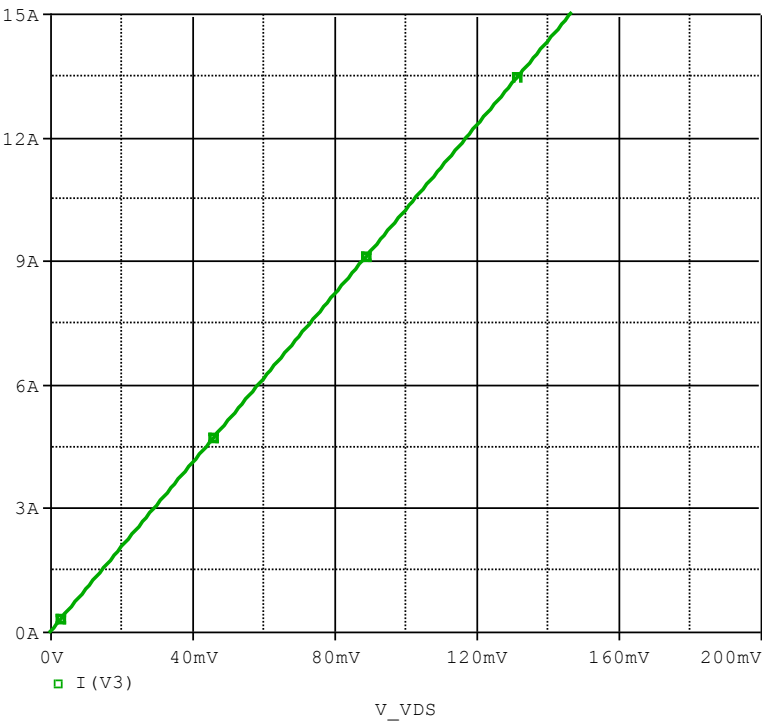


Simulation Result

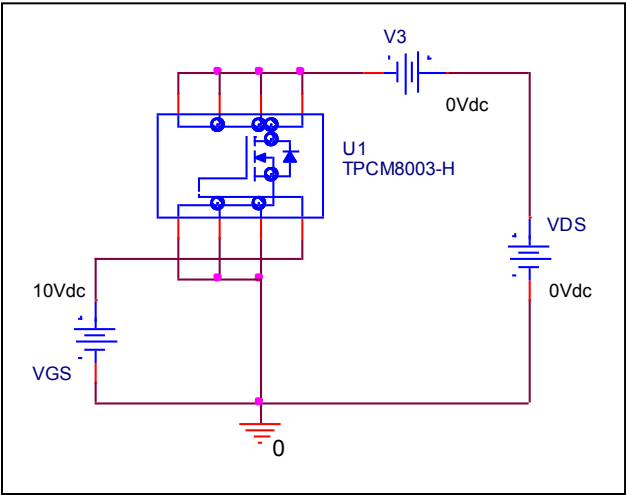
ID(A)	VGS(V)		Error (%)
	Measurement	Simulation	
0.100	2.590	2.570	-0.772
0.200	2.660	2.600	-2.256
0.500	2.700	2.640	-2.222
1.000	2.750	2.670	-2.909
2.000	2.850	2.750	-3.509
5.000	3.050	2.950	-3.279
10.000	3.200	3.100	-3.125
20.000	3.380	3.270	-3.254

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

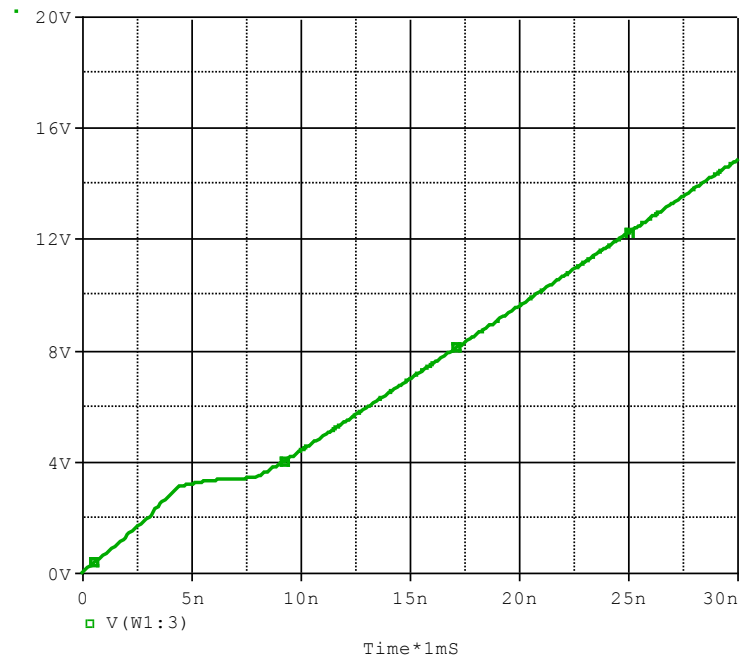


Simulation Result

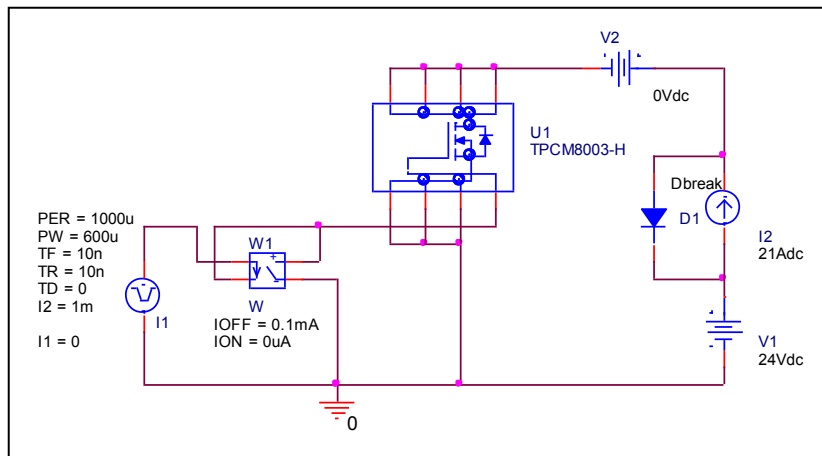
$I_D=11A, V_{GS}=10V$	Measurement	Simulation	Error (%)
$R_{DS} (on) (\Omega)$	0.0098	0.0098	0.000

Gate Charge Characteristic

Circuit Simulation result



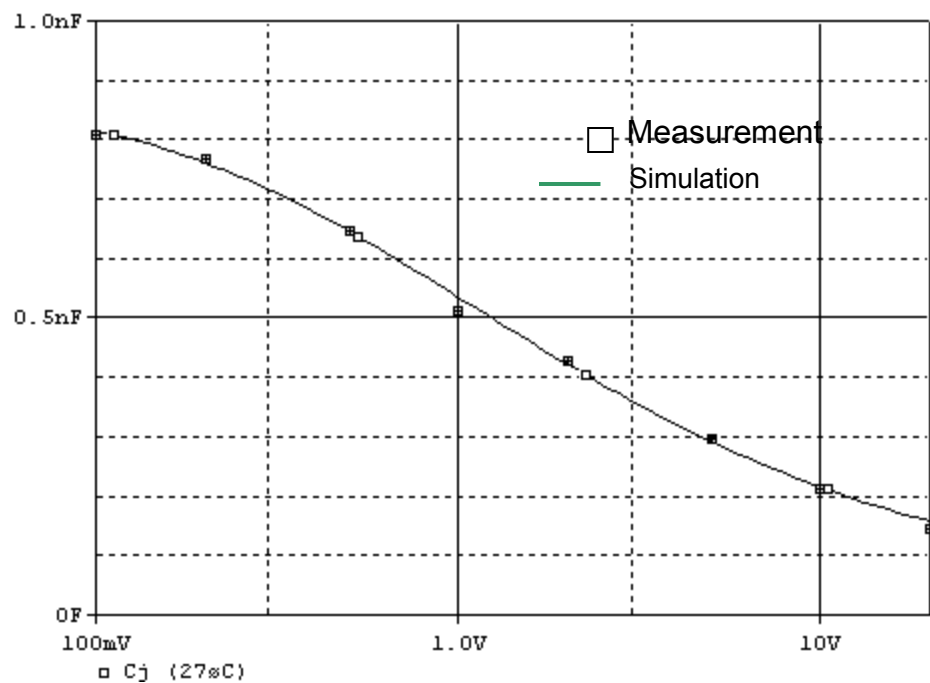
Evaluation circuit



Simulation Result

$V_{DD}=15V, I_D=3A$ $V_{GS}=10V$	Measurement	Simulation	Error (%)
$Q_{gs}(nc)$	4.700	4.683	-0.362
$Q_{gd}(nc)$	3.400	3.413	0.382
$Q_g(nc)$	21.000	20.800	-0.952

Capacitance Characteristic

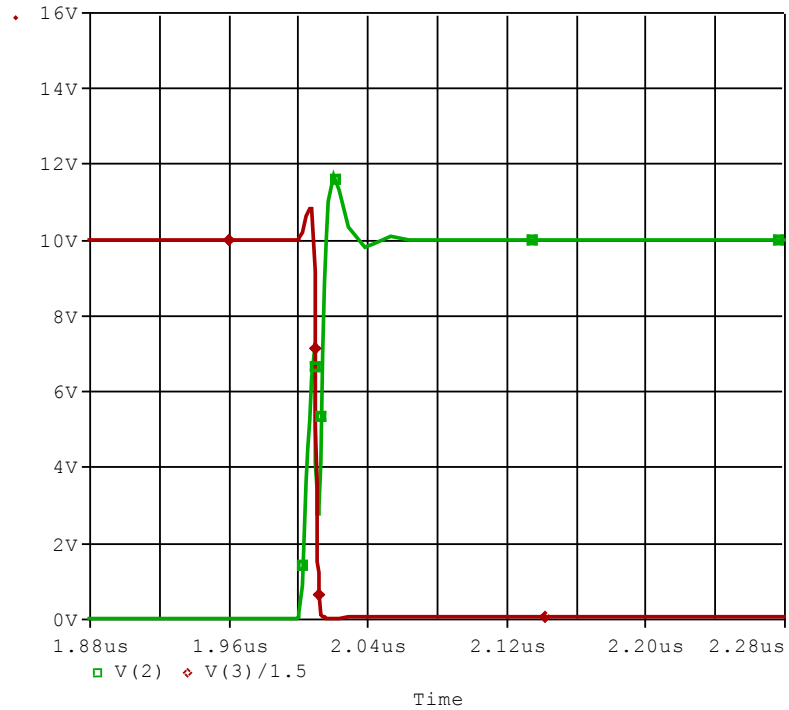


Simulation Result

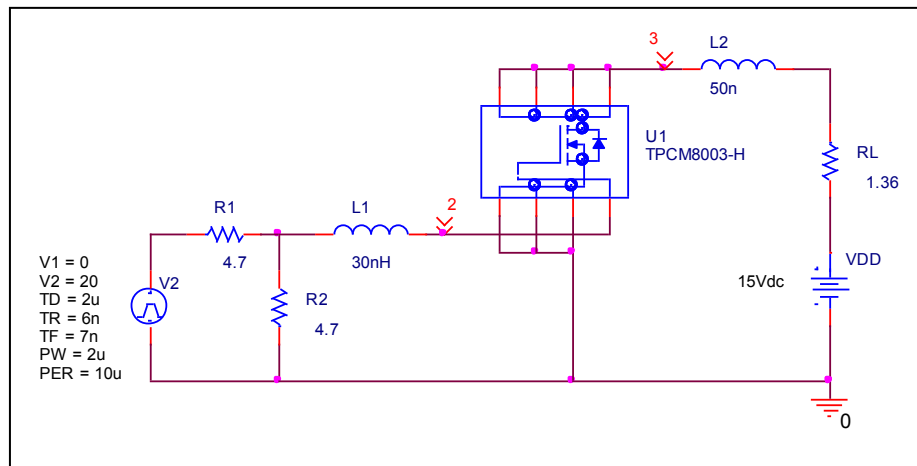
V _{DS} (V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.100	810.000	815.000	0.100
0.200	770.000	760.000	0.200
0.500	650.000	645.000	0.500
1.000	515.000	520.000	1.000
2.000	430.000	420.000	2.000
5.000	300.000	295.000	5.000
10.000	216.000	215.000	10.000
20.000	148.000	152.000	20.000

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

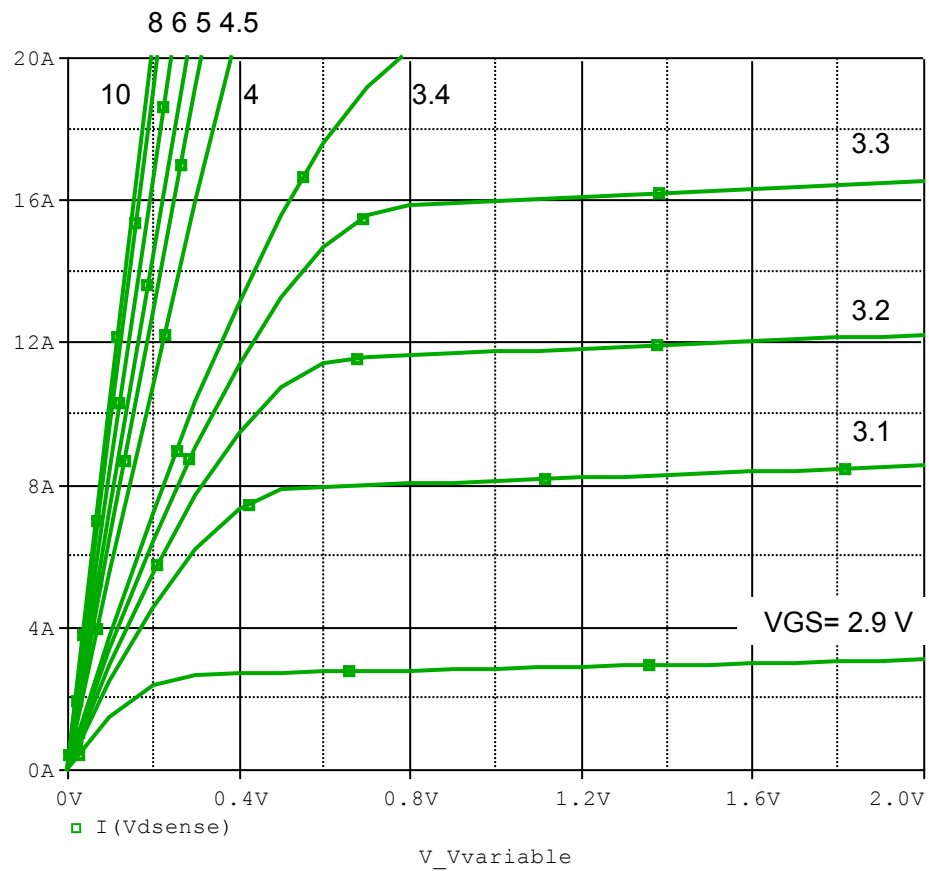


Simulation Result

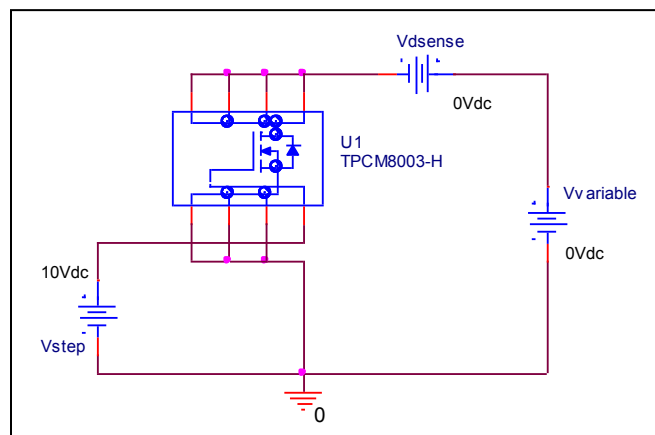
$I_D=11A$, $V_{DD}=15V$ $V_{GS}=10V$	Measurement	Simulation	Error(%)
Ton(ns)	9.300	9.290	-0.108

Output Characteristic

Circuit Simulation result

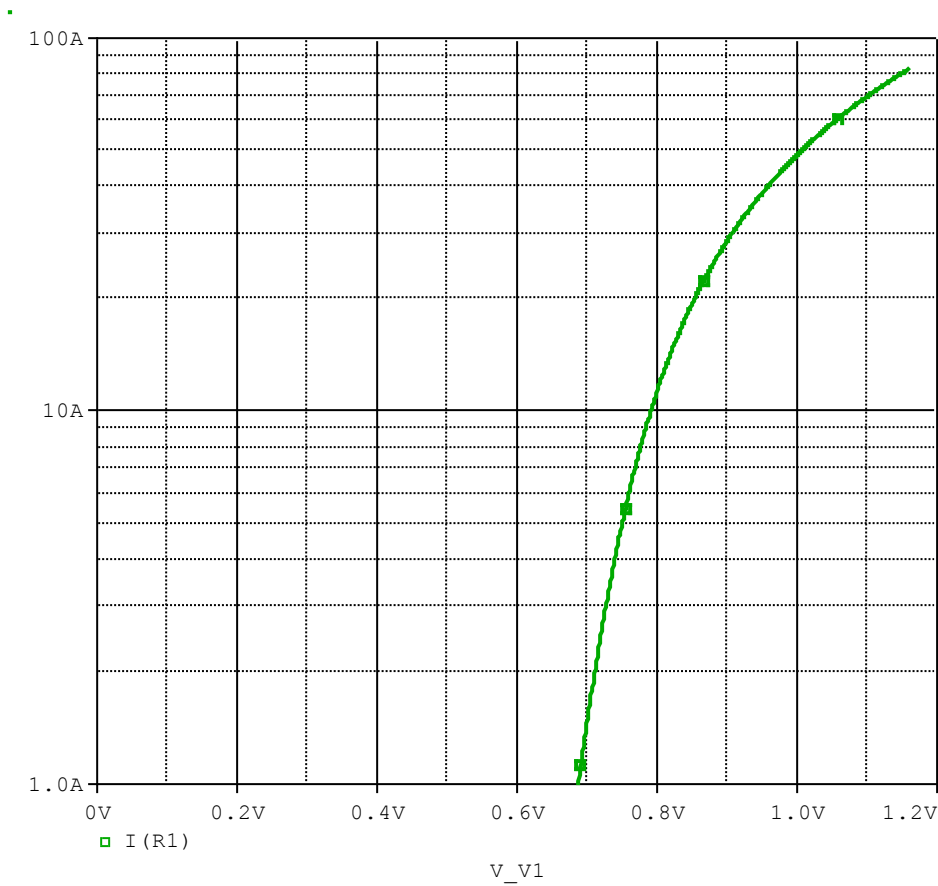


Evaluation circuit

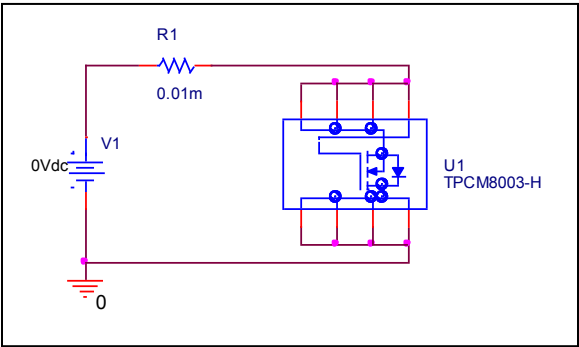


Forward Current Characteristic

Circuit Simulation Result

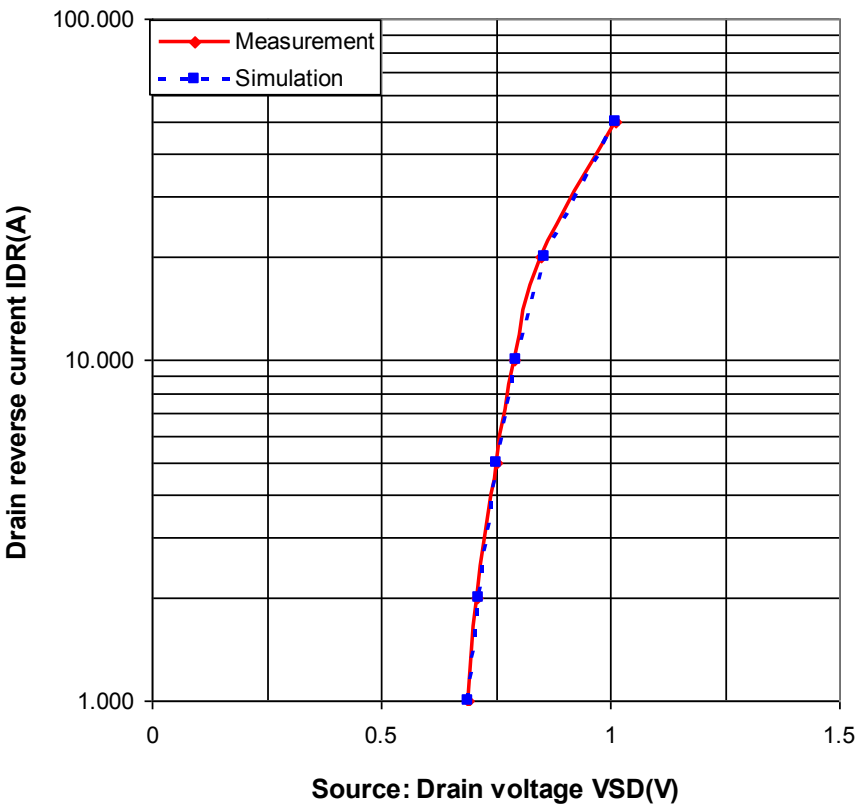


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

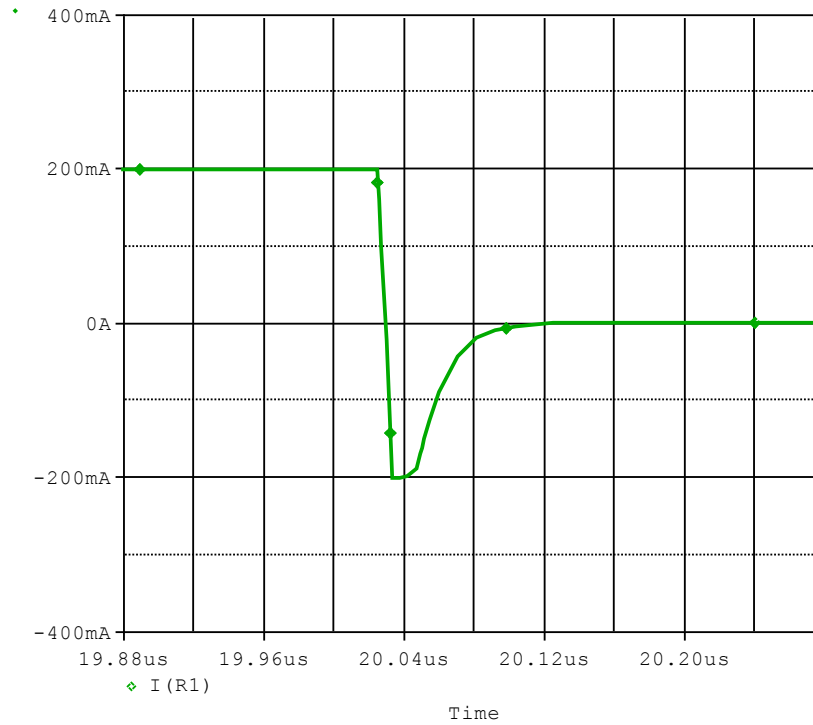


Simulation Result

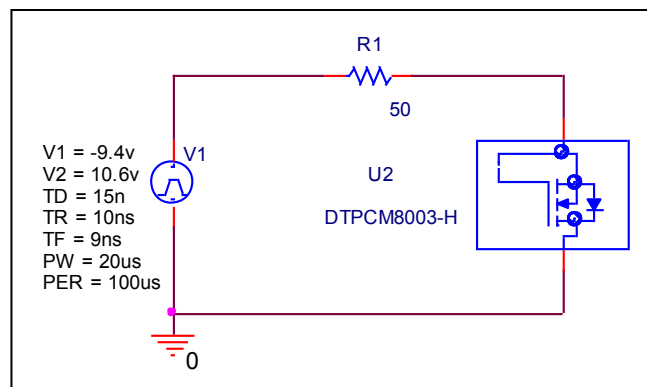
IDR(A)	VSD(V) Measurement	VSD(V) Simulation	%Error
1.000	0.690	0.690	0.000
2.000	0.710	0.712	0.282
5.000	0.750	0.751	0.133
10.000	0.790	0.793	0.380
20.000	0.850	0.855	0.588
50.000	1.010	1.010	0.000

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

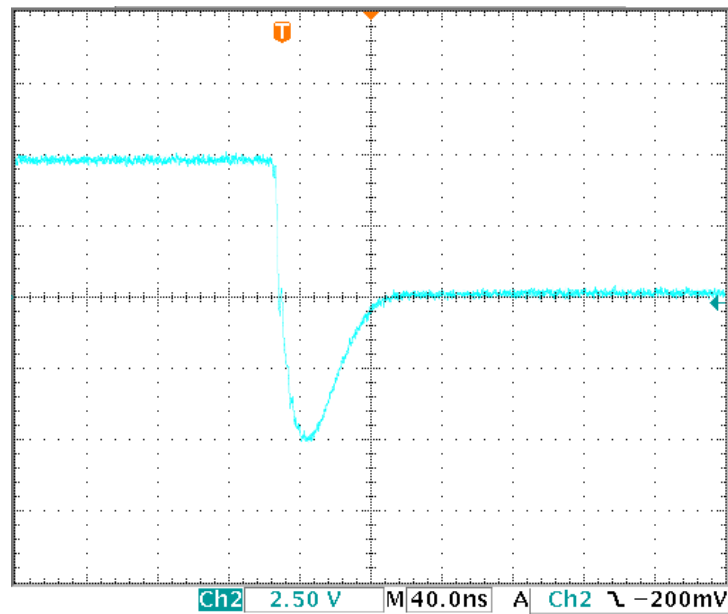


Compare Measurement vs. Simulation

	Measurement	Simulation	Error (%)
Trj(ns)	15.200	15.400	1.316
trb(ns)	33.600	33.800	0.595
trr(ns)	48.800	49.200	0.820

Reverse Recovery Characteristic

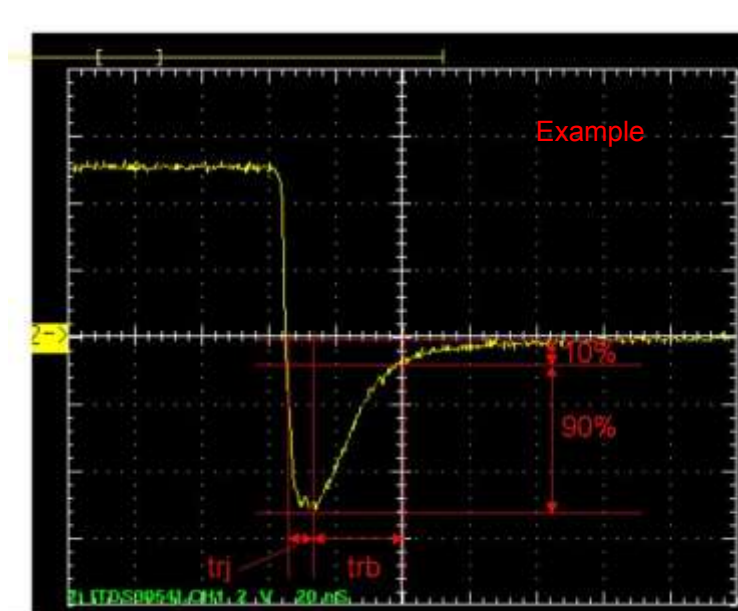
Reference



$T_{rj}=15.2$ (ns)

$T_{rb}=33.6$ (ns)

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



Relation between t_{rj} and t_{rb}