Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPCP8001-H
MANUFACTURER: TOSHIBA
Body Diode (Special) / ESD Protection Diode

Bee Technologies

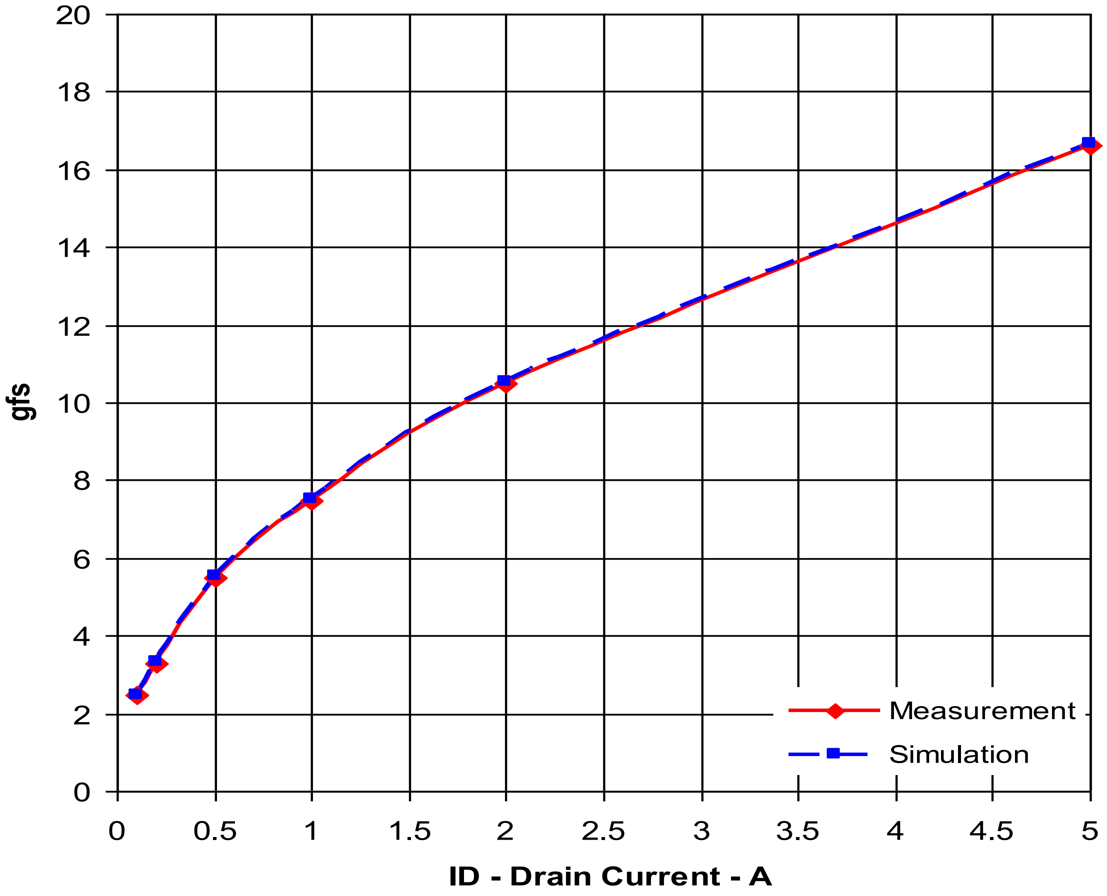
Bee Technologies Inc.

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	Mobility Modulation
KAPPA	Saturation Field Factor
VMAX	Maximum Drift Velocity of Carriers
XJ	Metallurgical Junction Depth
UO	Surface Mobility

Transconductance Characteristic

Circuit Simulation Result

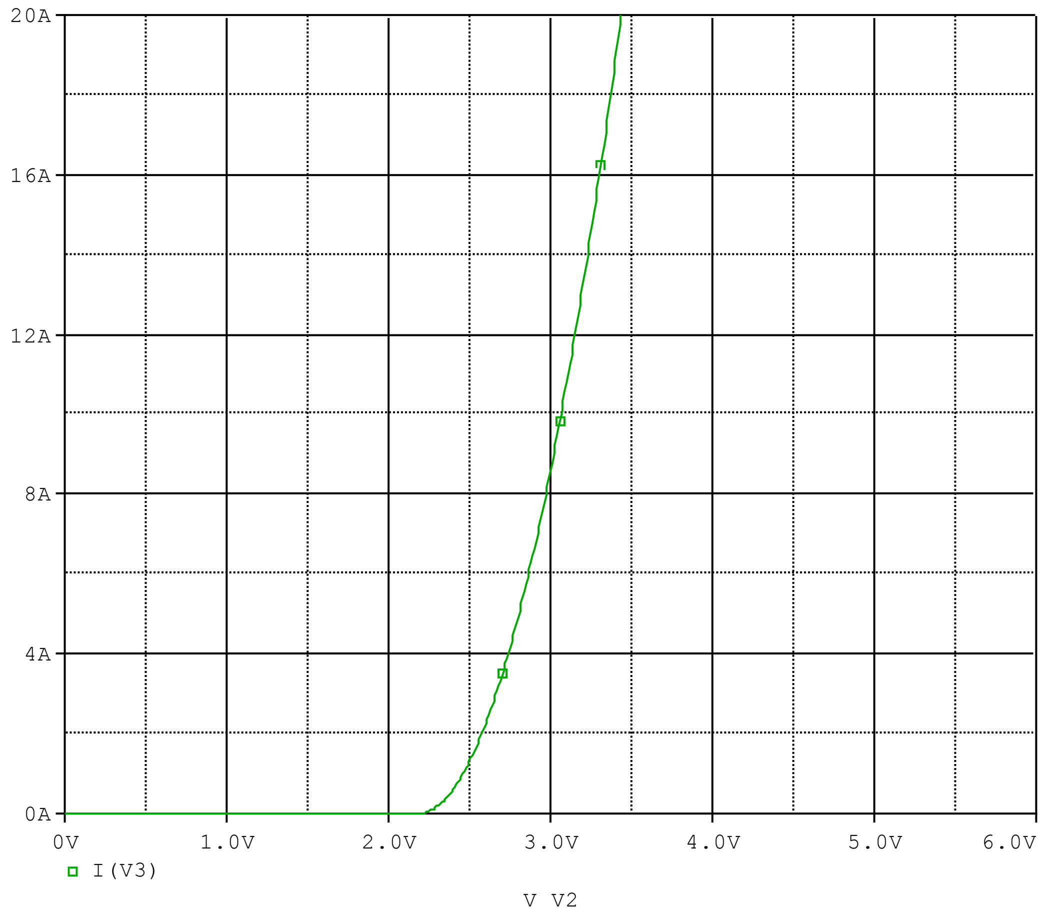


Comparison table

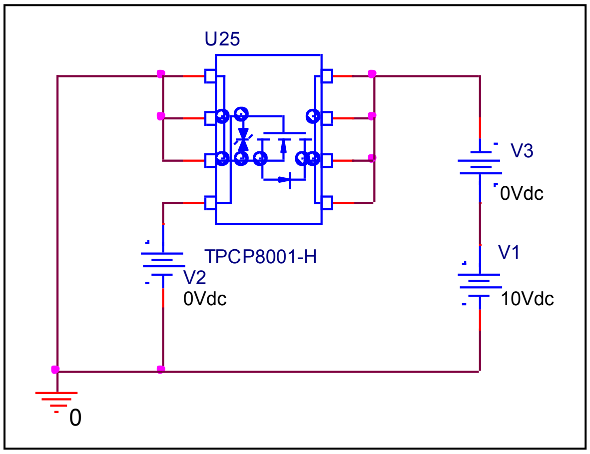
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	2.500	2.500	0.000
0.2	3.300	3.333	1.000
0.5	5.500	5.556	1.018
1	7.500	7.543	0.573
2	10.500	10.526	0.248
5	16.600	16.667	0.404

Vgs-Id Characteristic

Circuit Simulation result

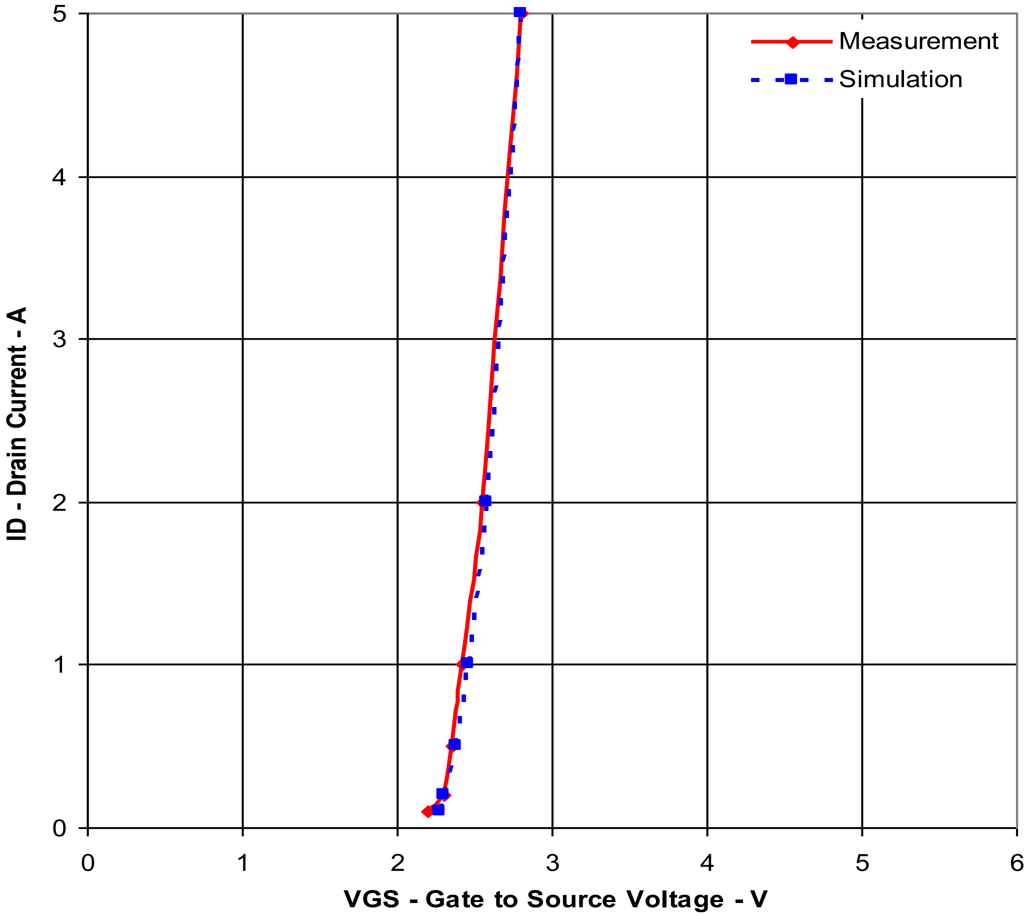


Evaluation circuit



Comparison Graph

Circuit Simulation Result

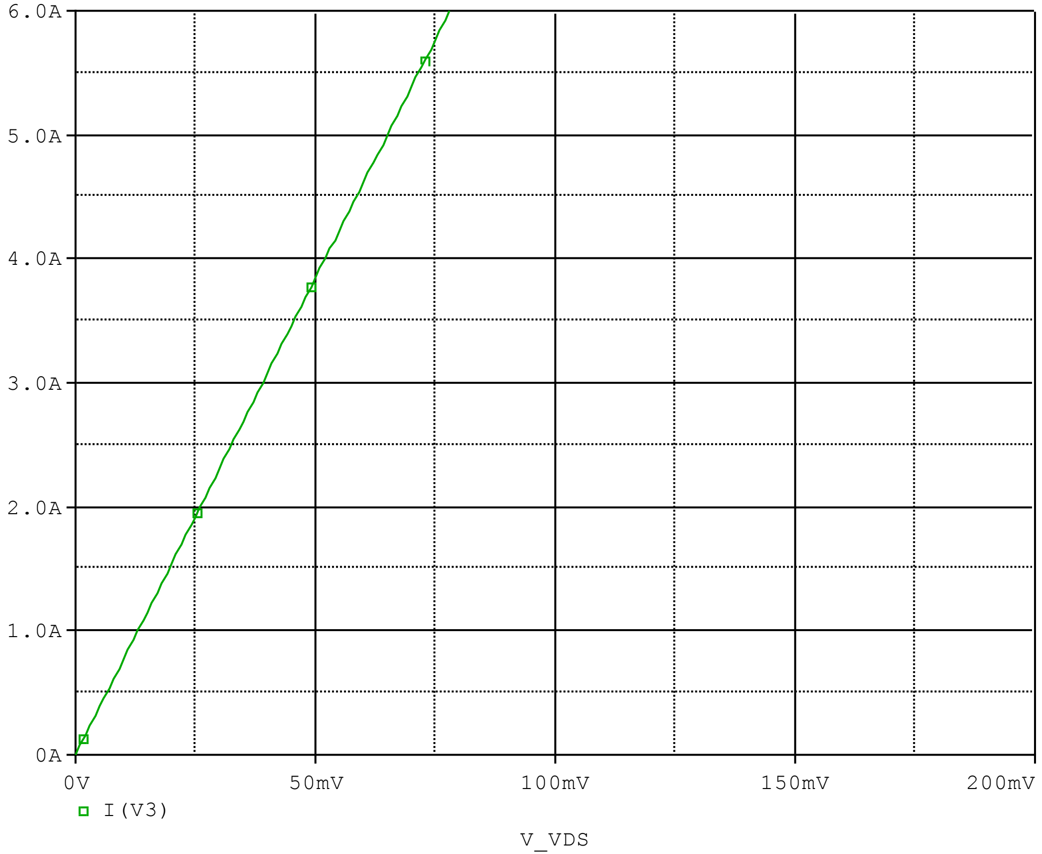


Simulation Result

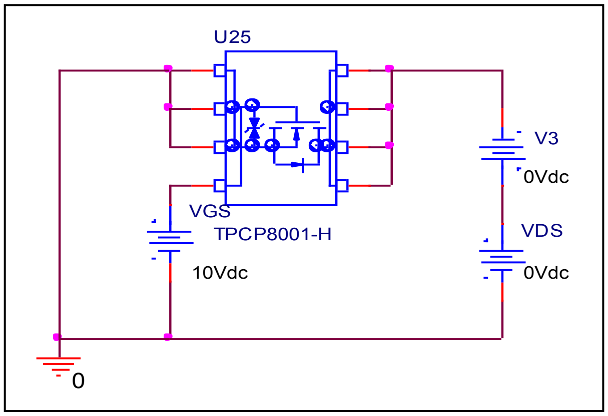
I_D(A)	V_{GS}(V)		Error (%)
	Measurement	Simulation	
0.1	2.200	2.271	3.227
0.2	2.300	2.307	0.304
0.5	2.350	2.379	1.234
1	2.420	2.46	1.653
2	2.550	2.575	0.980
5	2.800	2.805	0.179

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

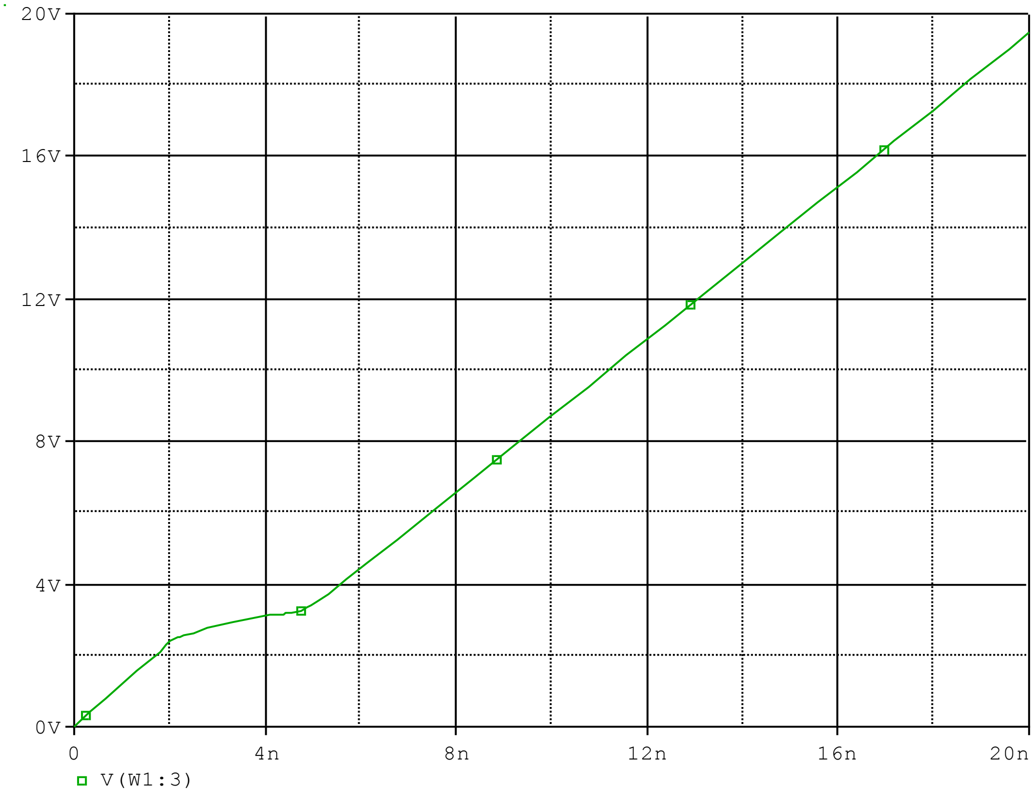


Simulation Result

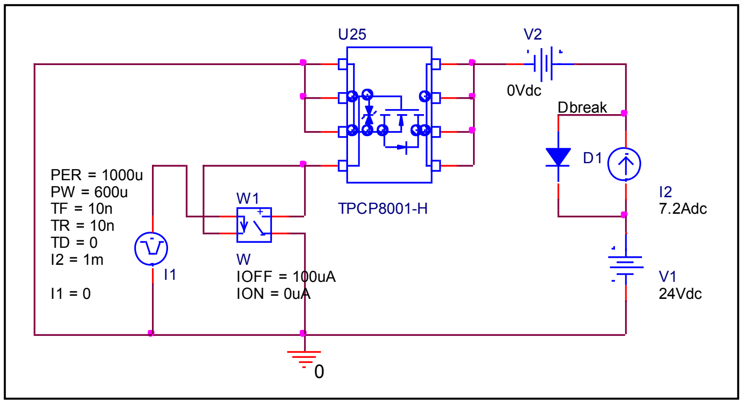
I_D=3.6A, V_{GS}=10V	Measurement		Simulation		Error (%)
R_{DS} (on)	0.013	Ω	0.013	Ω	0

Gate Charge Characteristic

Circuit Simulation result



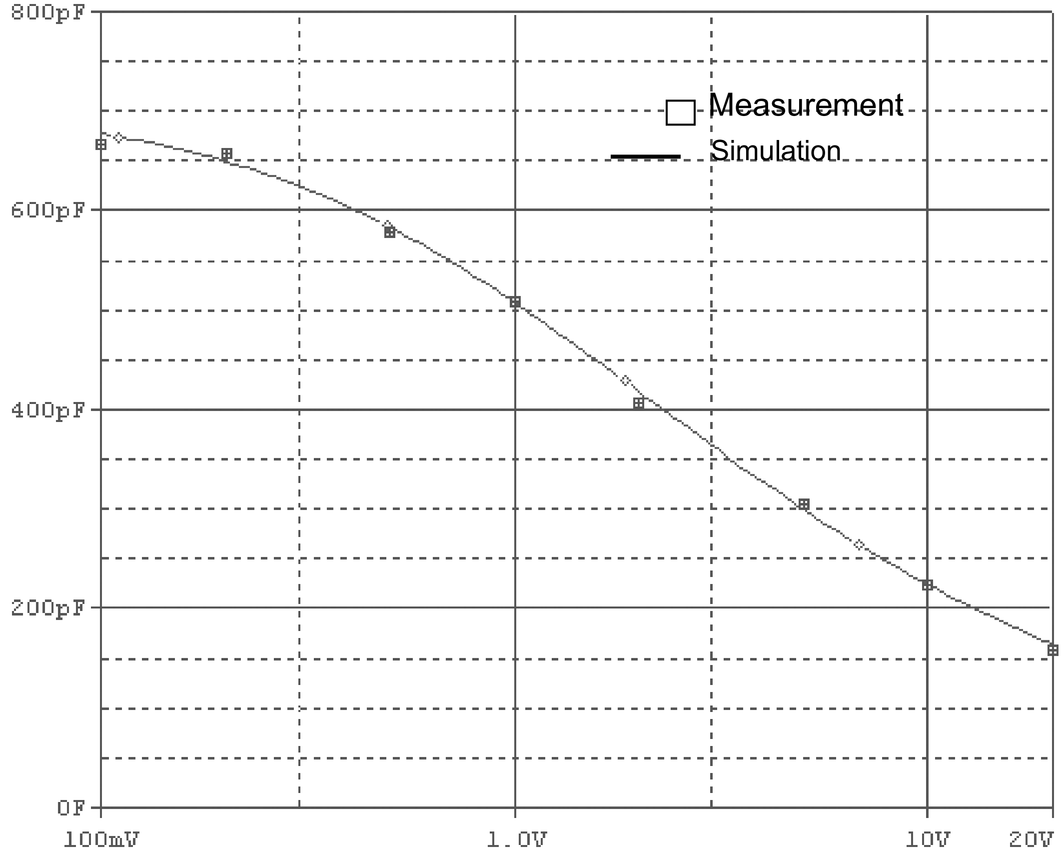
Evaluation circuit



Simulation Result

V_{DD}=24V,I_D=7.2A ,V_{GS}=10V	Measurement	Simulation	Error (%)
Qgs(nC)	2.200	2.172	-1.273
Qgd(nC)	2.600	2.623	0.885
Qg	11.000	11.189	1.718

Capacitance Characteristic

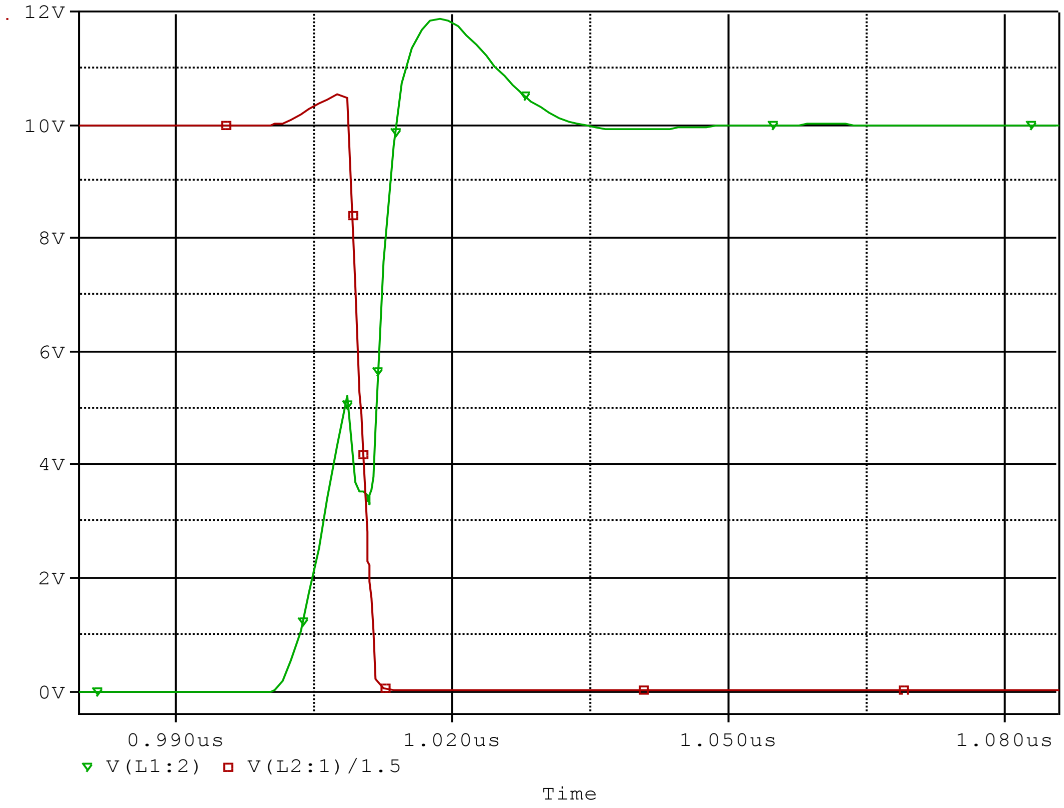


Simulation Result

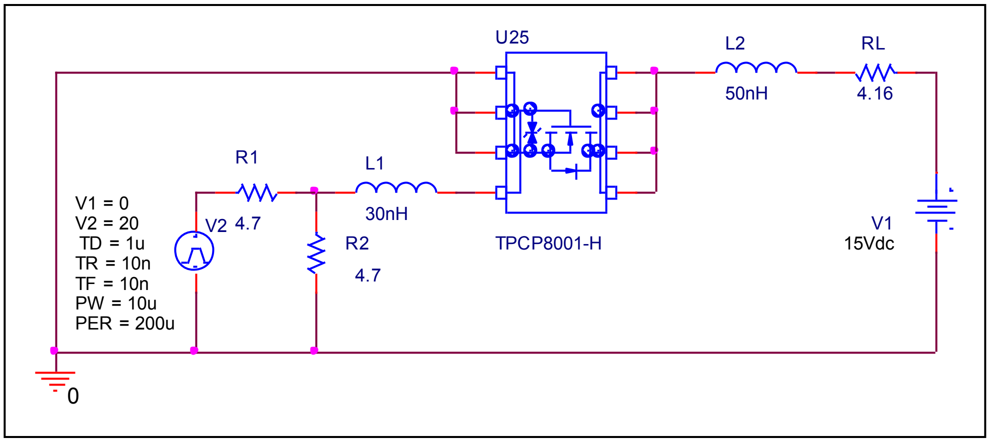
V_{DS}(V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	680.000	670.000	-1.471
0.2	650.000	660.000	1.538
0.5	583.000	580.000	-0.515
1	510.000	510.000	0.000
2	420.000	410.000	-2.381
5	305.000	307.000	0.656
10	225.000	225.000	0.000
20	162.000	160.000	-1.235

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

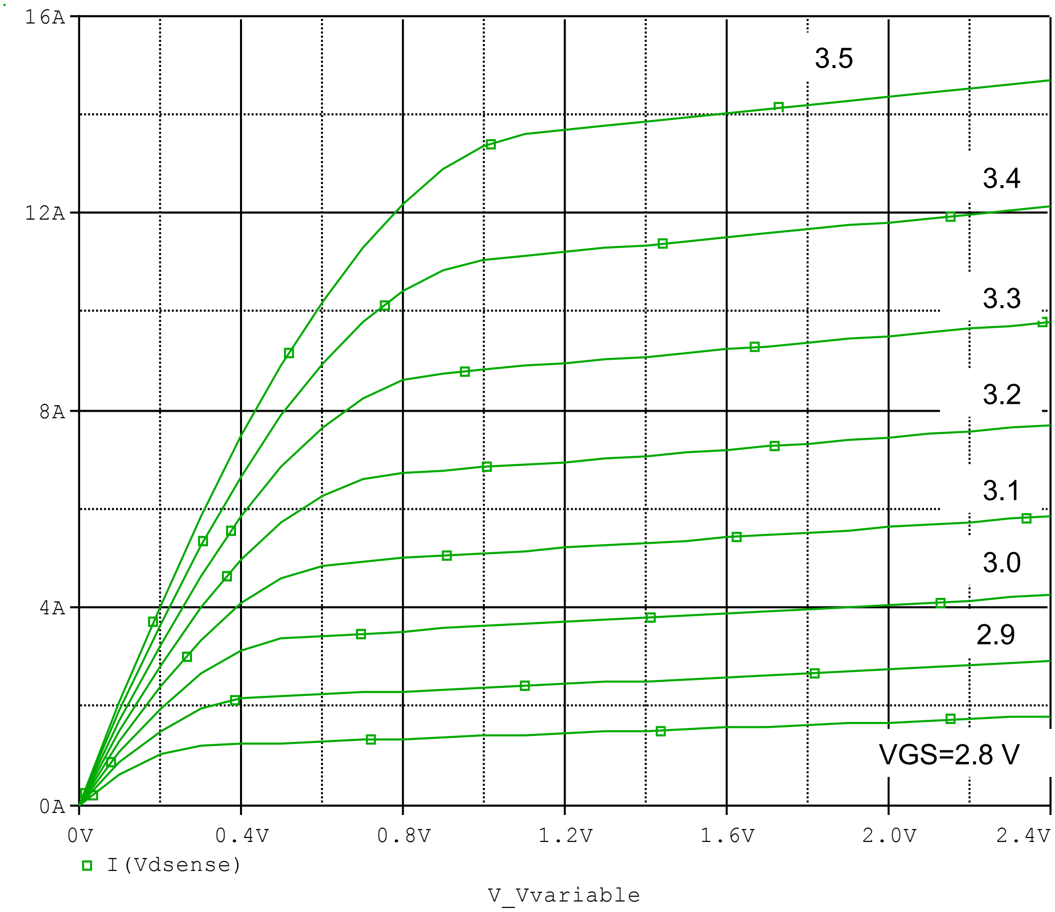


Simulation Result

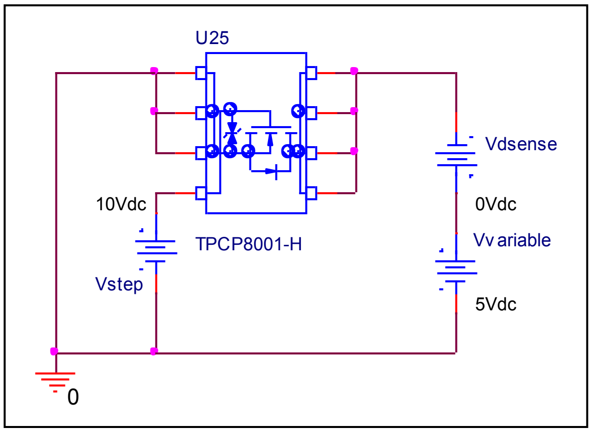
I_D=3.6 A, V_{DD}=15V V_{GS}=0/10V	Measurement	Simulation	Error(%)
Ton(ns)	8.000	8.009	0.113

Output Characteristic

Circuit Simulation result

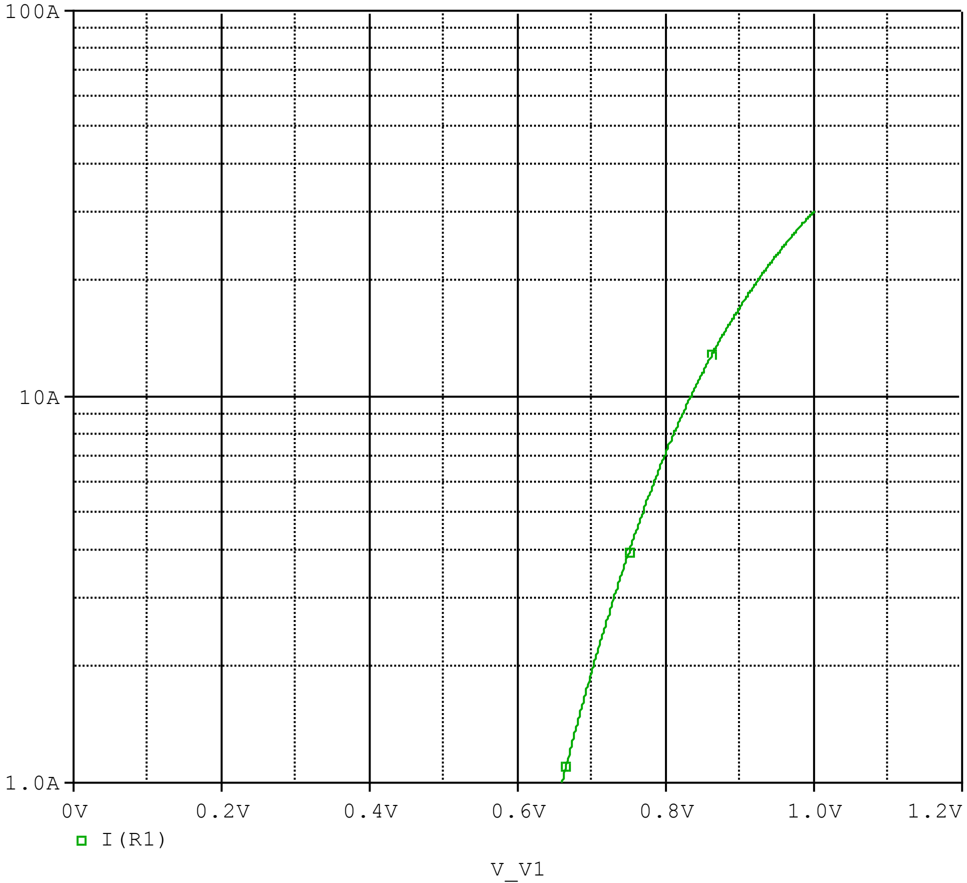


Evaluation circuit

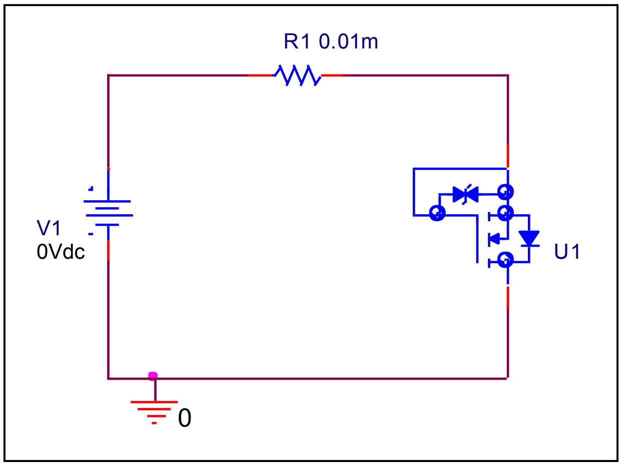


Forward Current Characteristic

Circuit Simulation Result

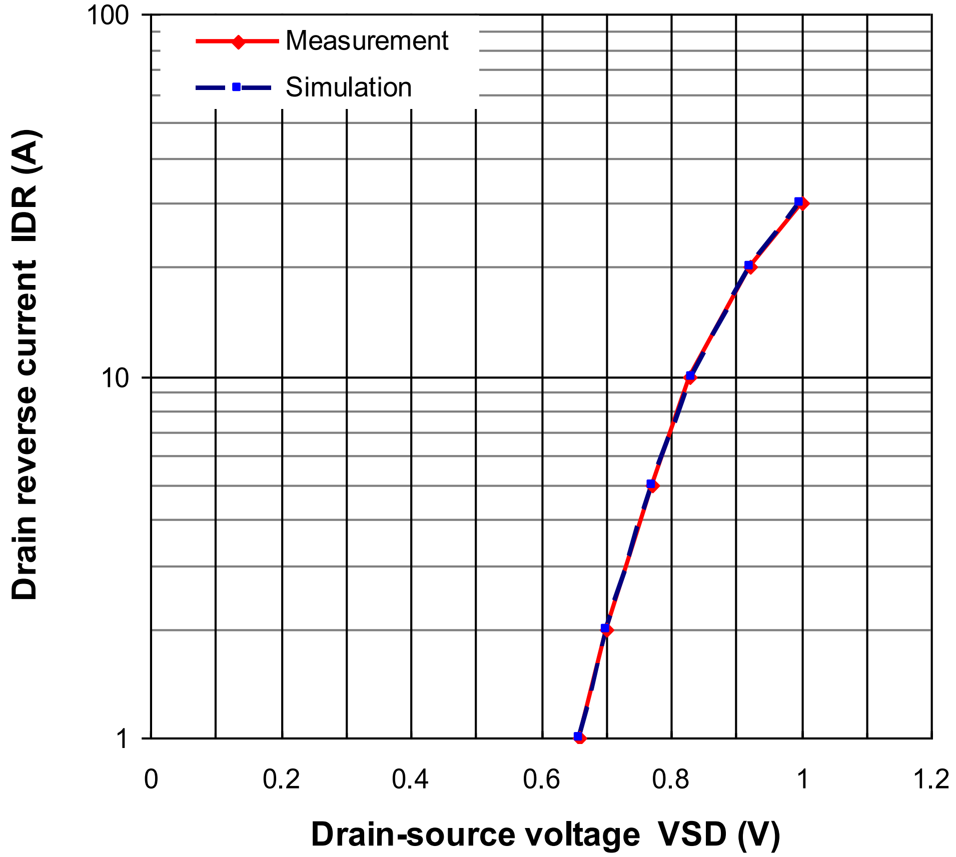


Evaluation Circuit



Comparison Graph

Circuit Simulation Result



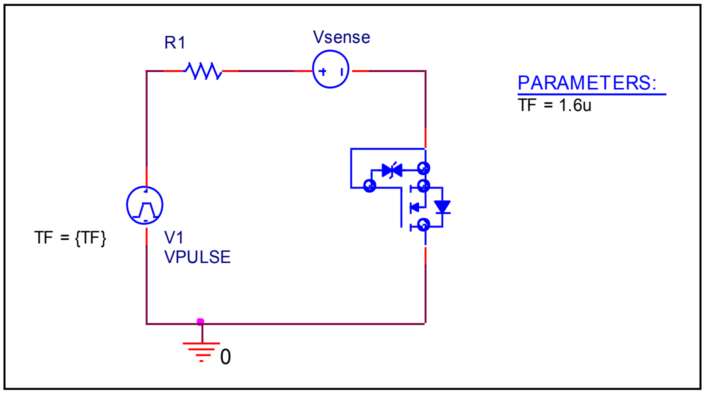
Simulation Result

IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
1	0.6600	0.6590	-0.15
2	0.7000	0.7010	0.14
5	0.7700	0.7700	0.00
10	0.8300	0.8330	0.36
20	0.9200	0.9230	0.33

Reverse Recovery Characteristics (Body Diode)

Circuit Simulation Result

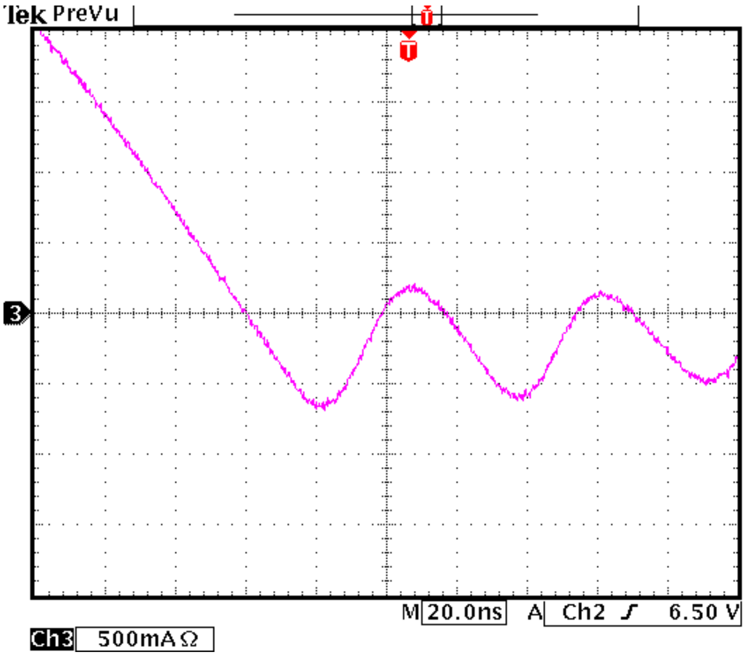
Evaluation Circuit



Compare Measurement vs. Simulation

	Measurement		Simulation		Error (%)
trr	**35.6**	**ns**	**35.222**	**ns**	**-1.06**

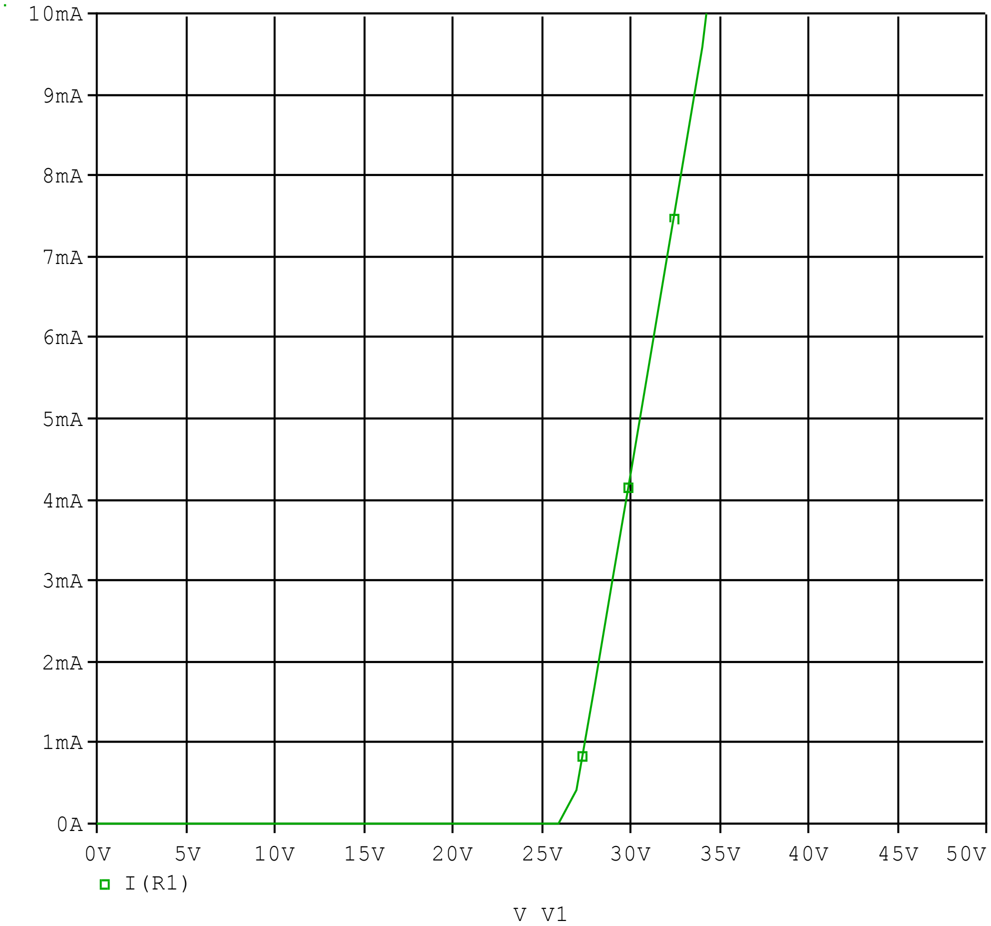
Reverse Recovery Characteristic (Body Diode) Reference



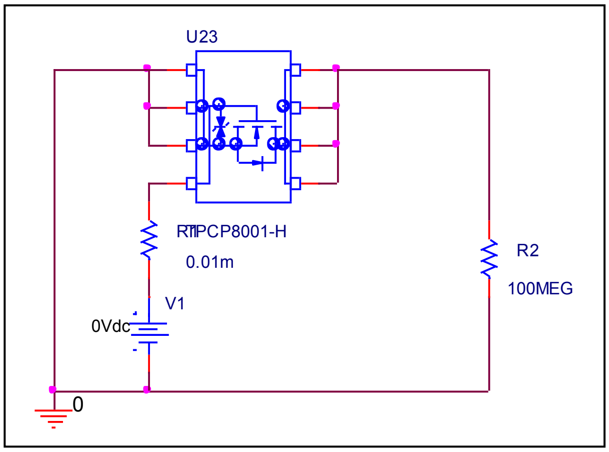
Trr=42.8ns
Conditions:Ifwd=di/dt=30A/us

Zener Voltage Characteristic

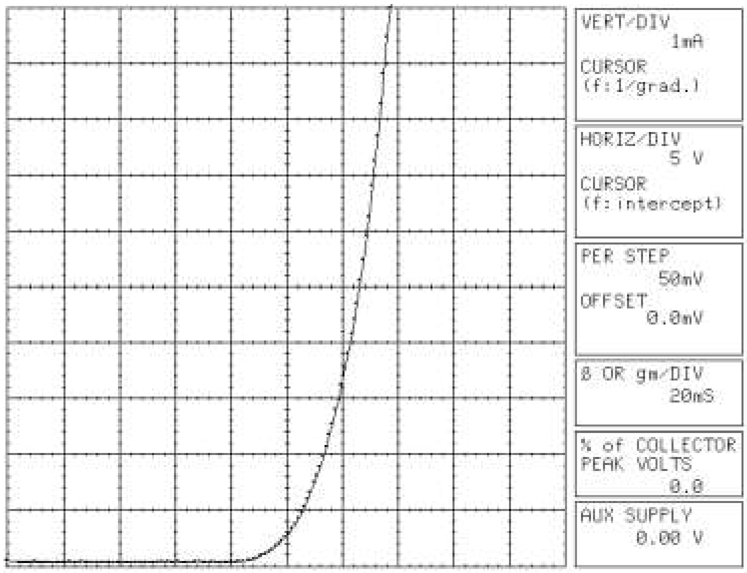
Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic **Reference**



VERT/DIV
1mA
CURSOR
(f:1/grad.)

HORIZ/DIV
5 V
CURSOR
(f:intercept)

PER STEP
50mV
OFFSET
0.0mV

β OR gm/DIV
20mS

% of COLLECTOR
PEAK VOLTS
0.0

AUX SUPPLY
0.00 V