

Device Modeling Report

COMPONENTS: Power MOSFET (Model Parameter)
PART NUMBER: 2SK3108
MANUFACTURER: NEC
Body Diode (Model Parameter) / ESD Protection Diode

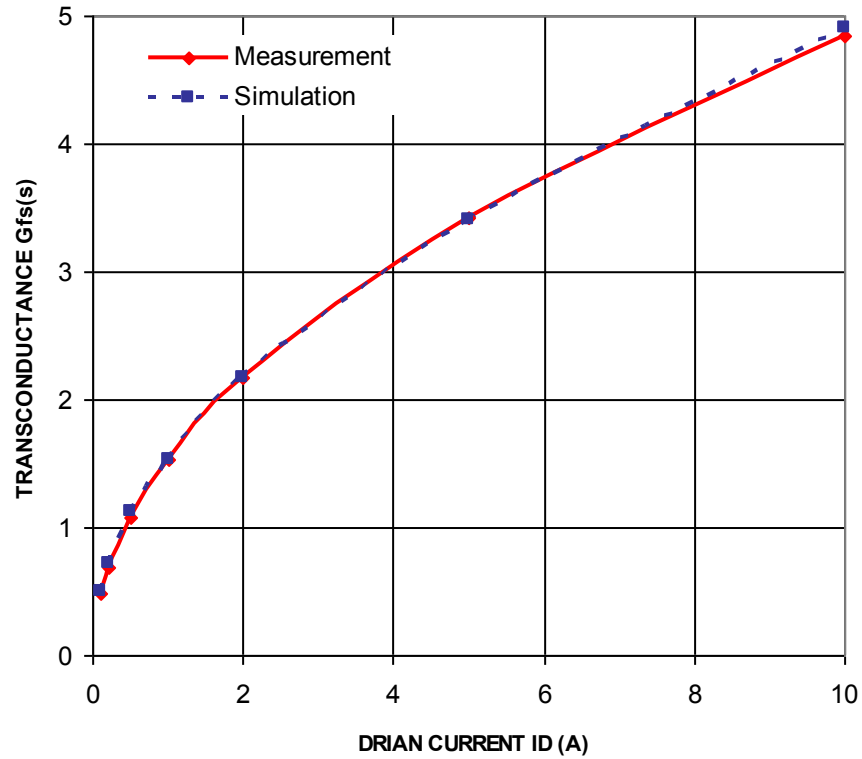


MOSFET MODEL

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

Transconductance Characteristic

Circuit Simulation Result

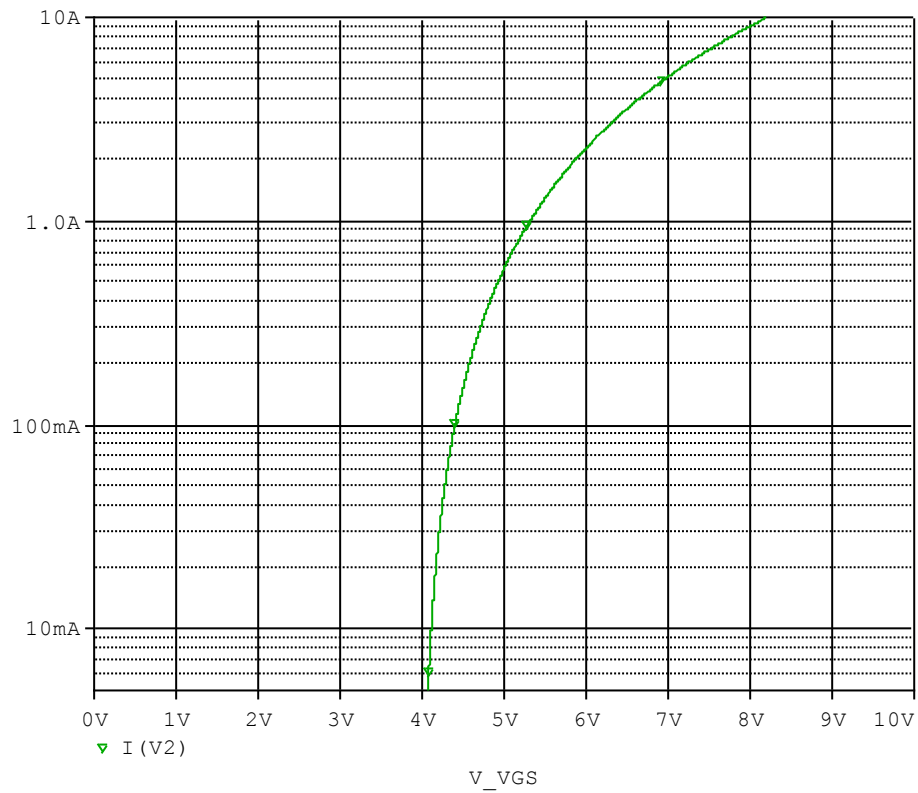


Comparison table

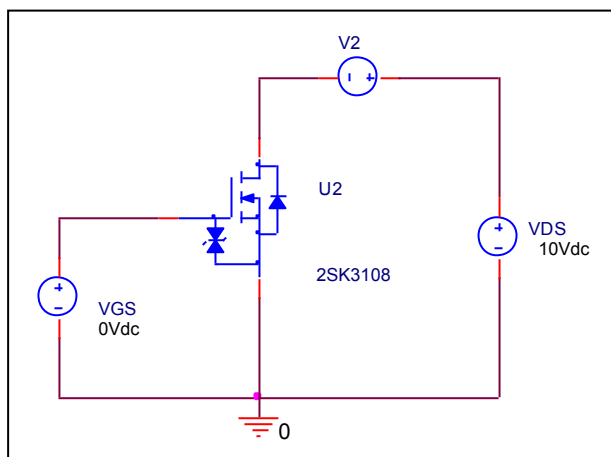
Id(A)	gfs		Error (%)
	Measurement	Simulation	
0.1	0.478	0.495	3.455
0.2	0.685	0.715	4.390
0.5	1.085	1.120	3.264
1	1.534	1.534	0.000
2	2.179	2.172	-0.337
5	3.425	3.400	-0.720
10	4.840	4.900	1.234

Vgs-Id Characteristic

Circuit Simulation result

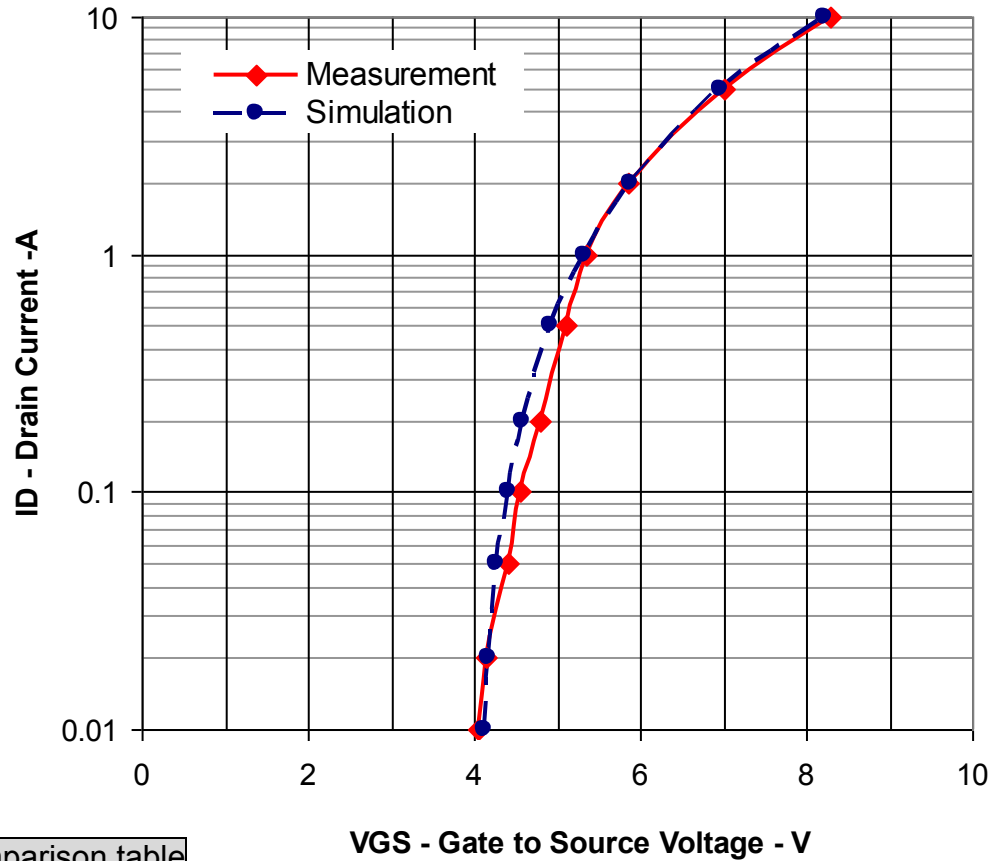


Evaluation circuit



Comparison Graph

Circuit Simulation Result

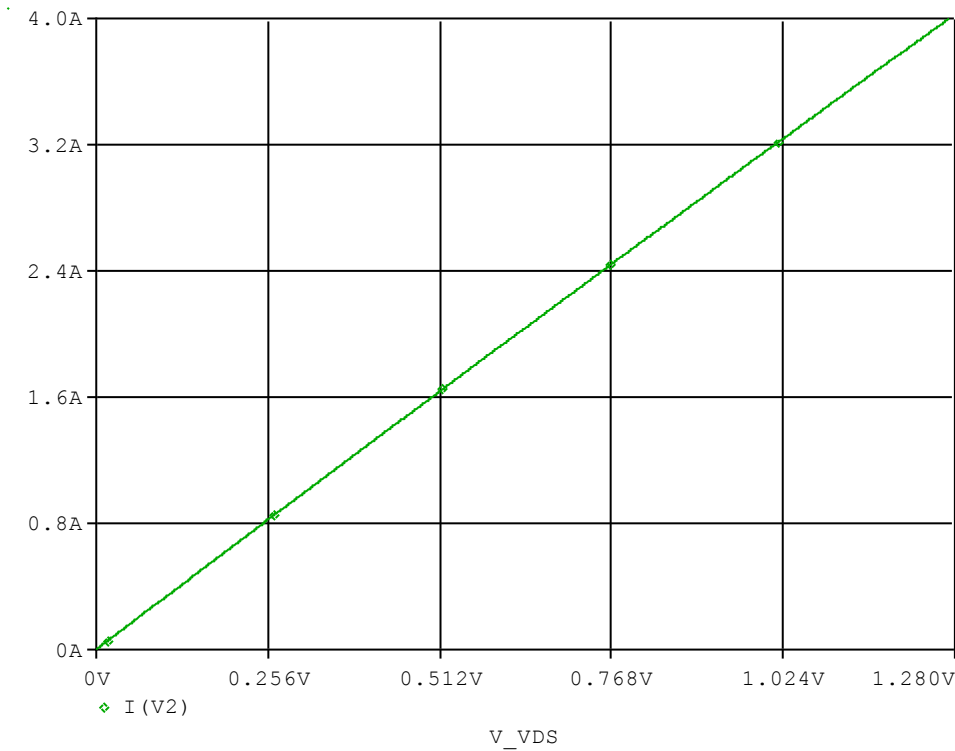


Comparison table

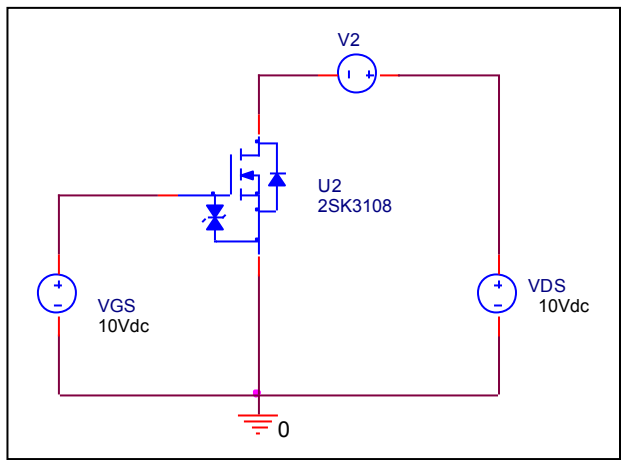
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
0.01	4.050	4.111	1.499
0.02	4.150	4.166	0.386
0.05	4.400	4.276	-2.820
0.1	4.550	4.400	-3.305
0.2	4.800	4.575	-4.694
0.5	5.100	4.922	-3.488
1	5.350	5.314	-0.680
2	5.850	5.868	0.299
5	7.000	6.966	-0.480
10	8.300	8.206	-1.139

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

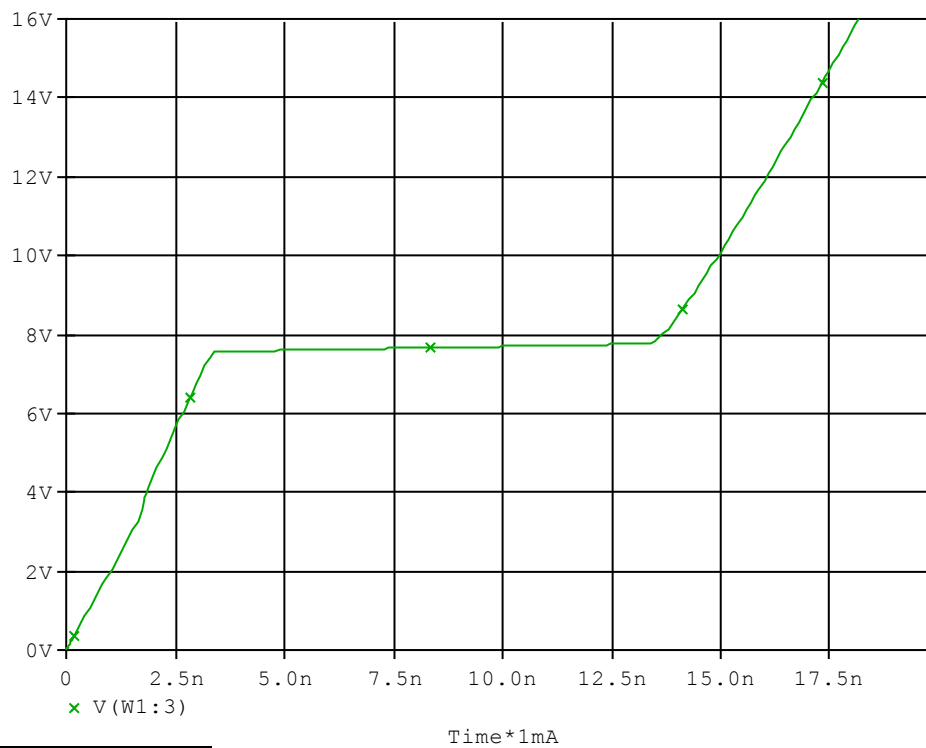


Comparison table

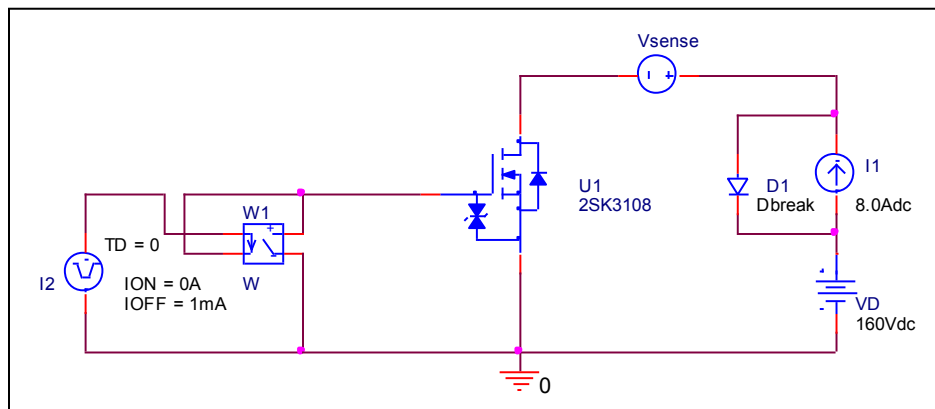
$I_D=4.0A, V_{GS}=10V$	Measurement	Simulation	Error (%)
$R_{DS(on)} \Omega$	0.32	0.32	0.00

Gate Charge Characteristic

Circuit Simulation result



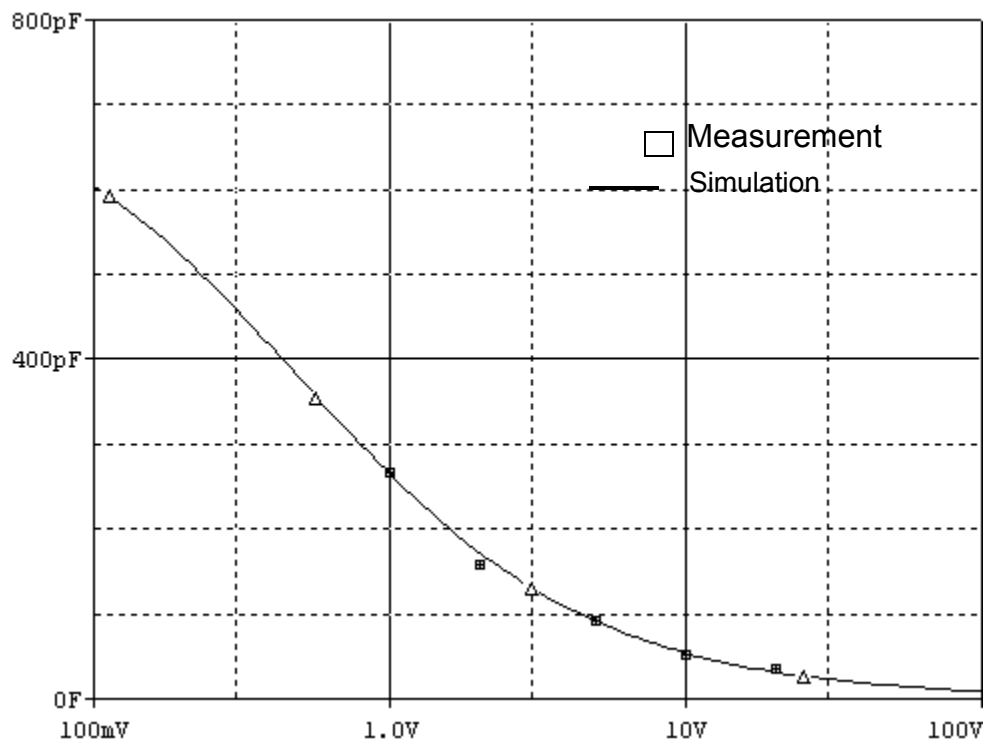
Evaluation circuit



Comparison table

$V_{DD}=160V, I_D=8A,$ $V_{GS}=10V$		Measurement	Simulation	Error (%)
Qgs	nC	3.50	3.48	-0.63
Qgd	nC	10.00	10.03	0.30
Qg	nC	18.00	14.95	-16.96

Capacitance Characteristic

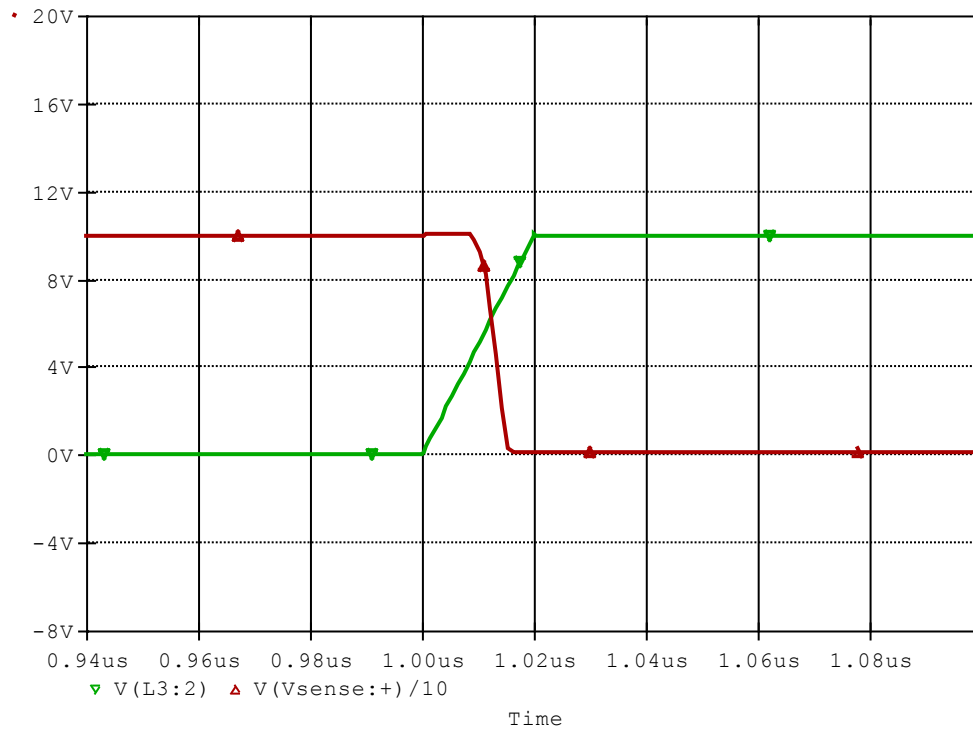


Comparison table

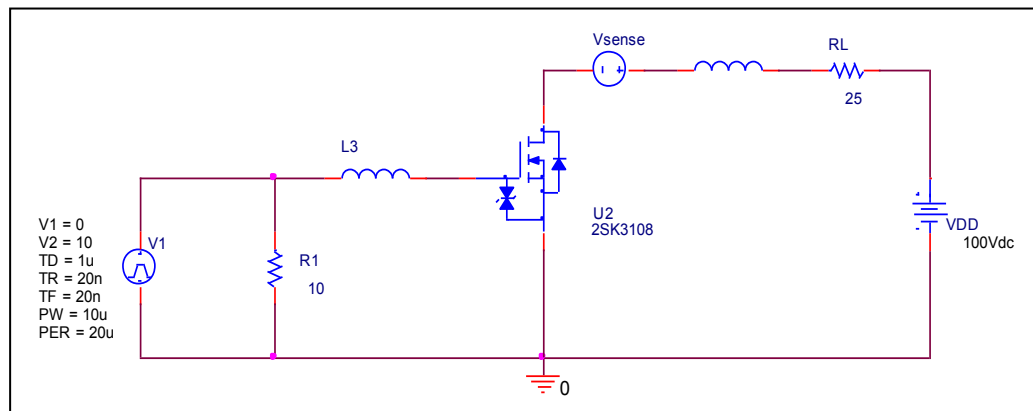
$V_{DS}(V)$	$C_{bd}(pF)$		Error(%)
	Measurement	Simulation	
1	270	265	-1.852
2	160	168	4.375
5	95	93	-2.105
10	55	56	1.818
20	37	35	-4.054

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

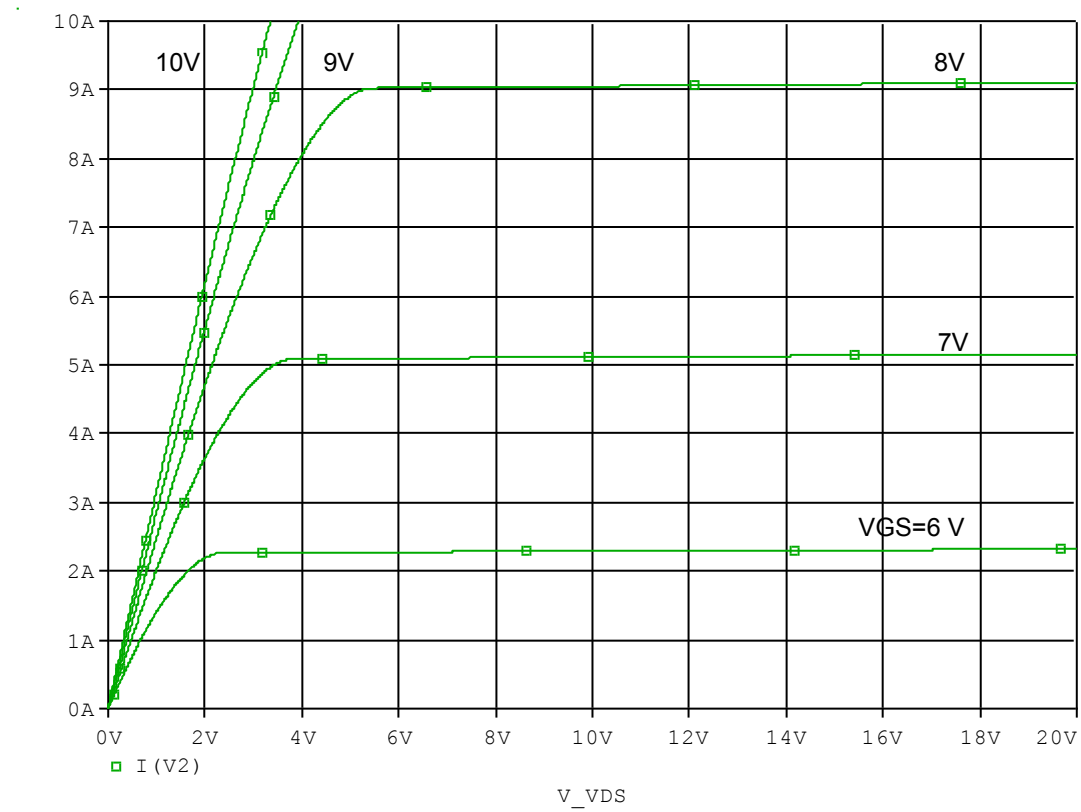


Comparison table

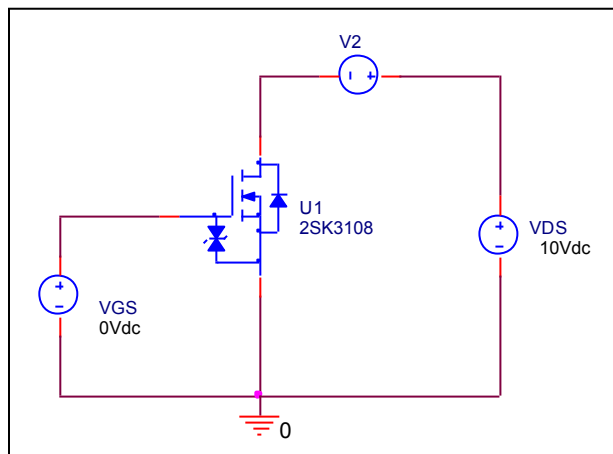
$I_D=4.0A$, $V_{DD}=100V$, $V_{GS}=0V\sim 10V$		Measurement	Simulation	Error(%)
t_{on}	ns	12.00	12.83	6.92

Output Characteristic

Circuit Simulation result

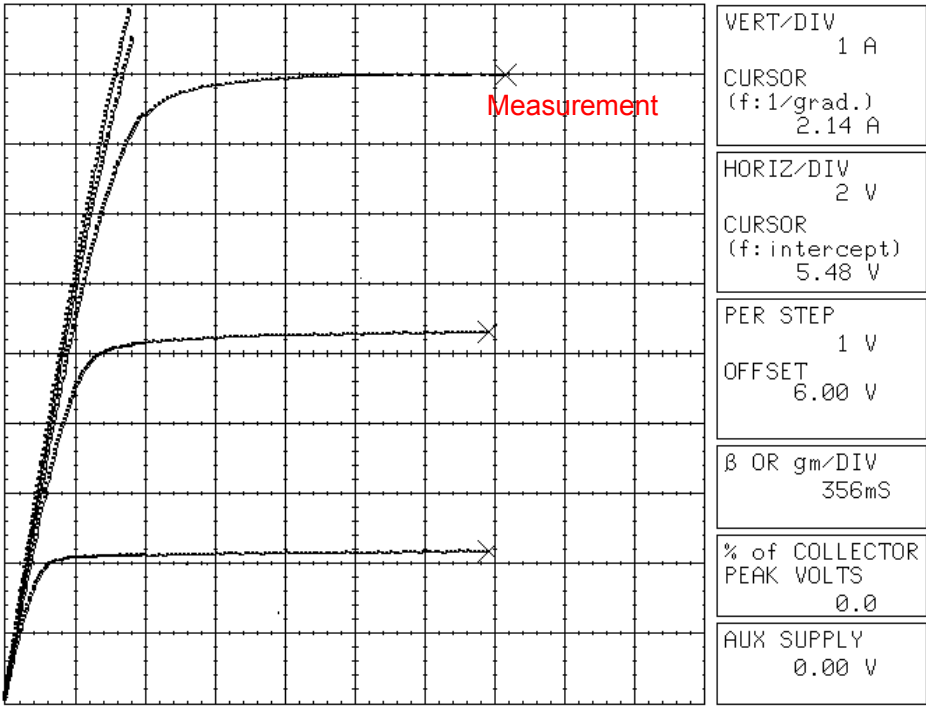


Evaluation circuit



Output Characteristic

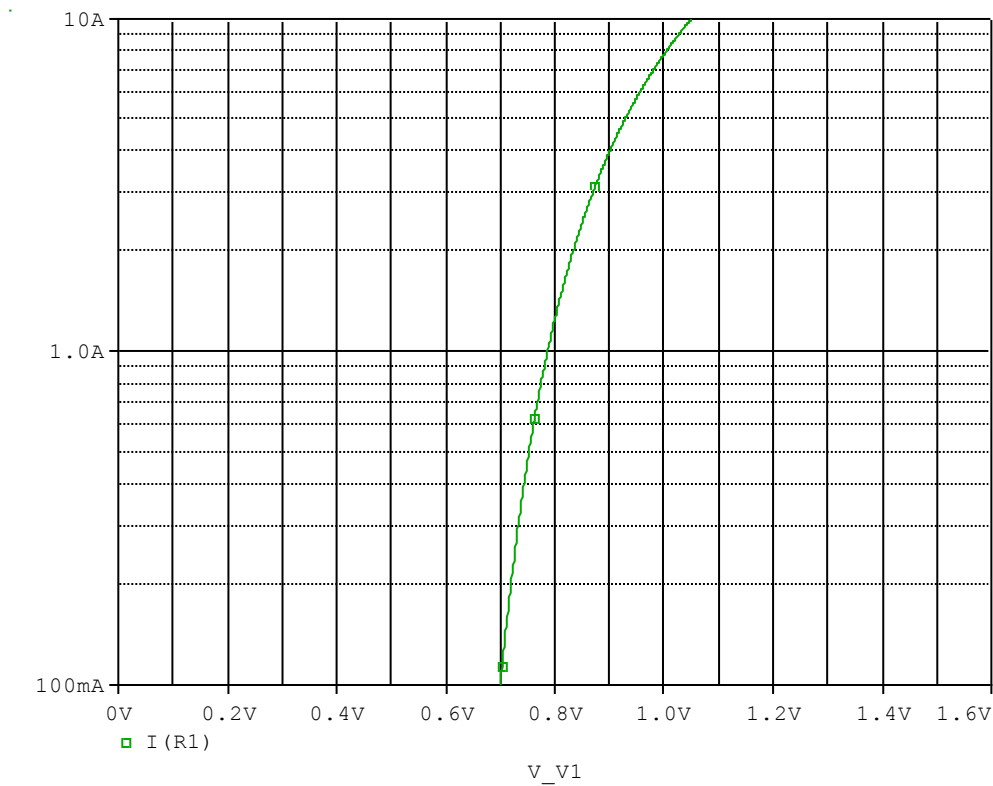
Reference



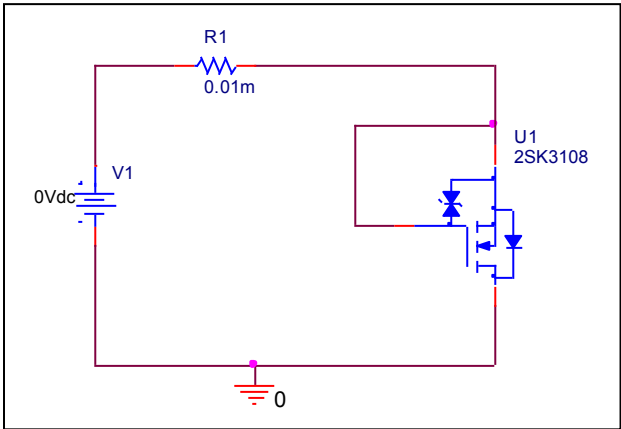
BODY DIODE

Forward Current Characteristic

Circuit Simulation Result

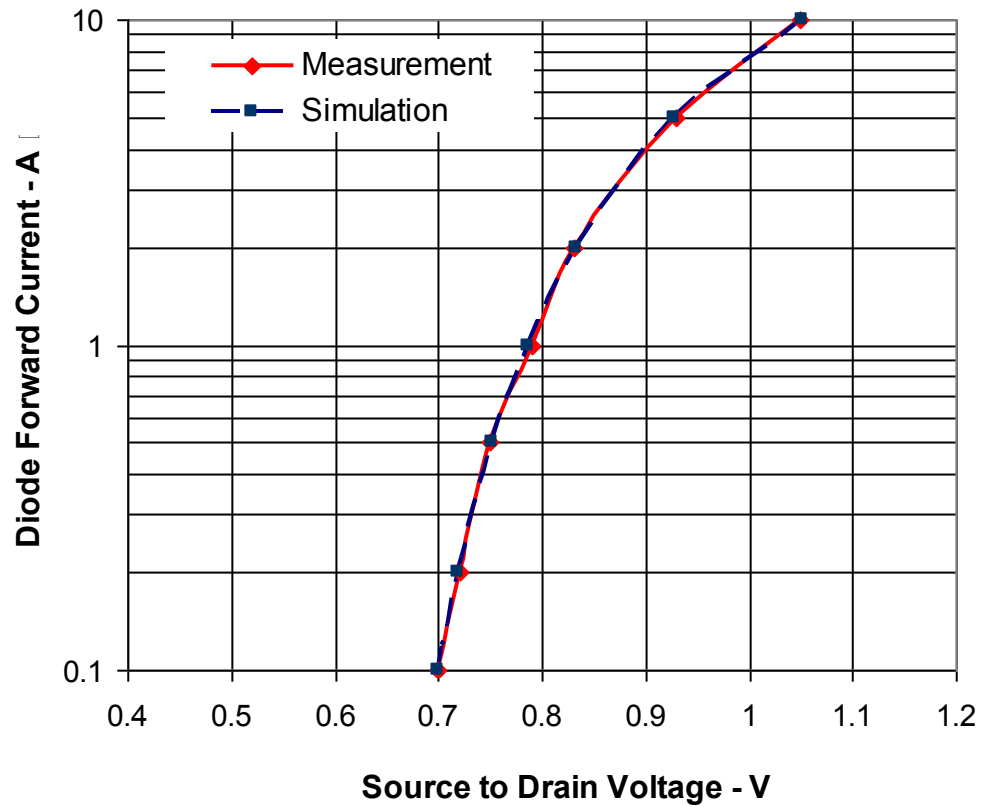


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

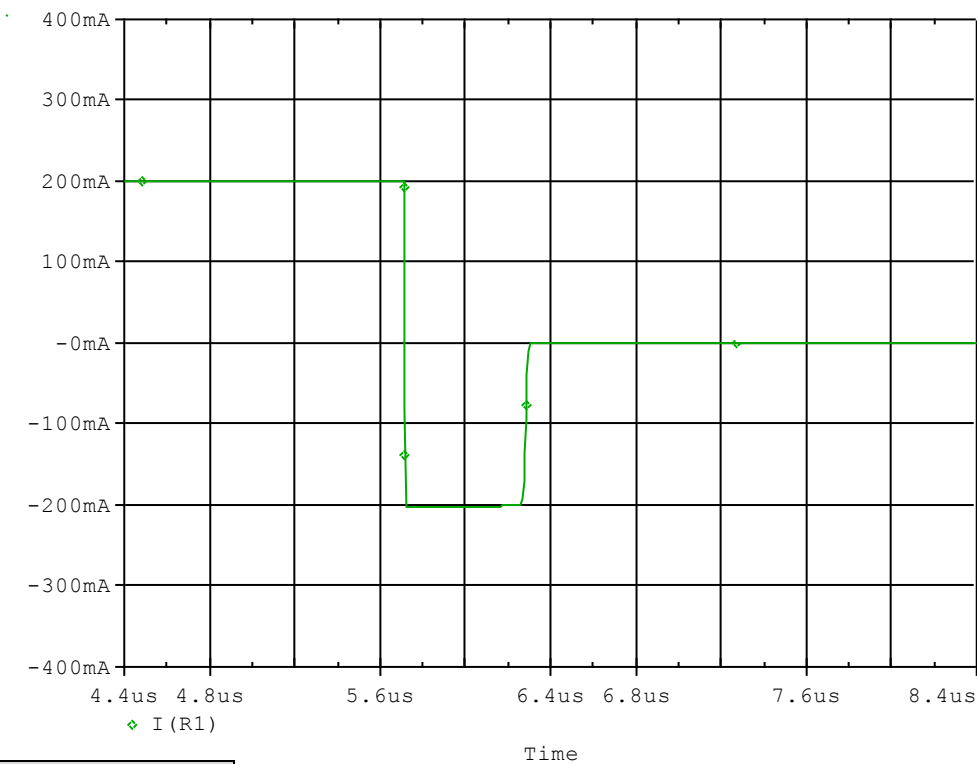


Comparison table

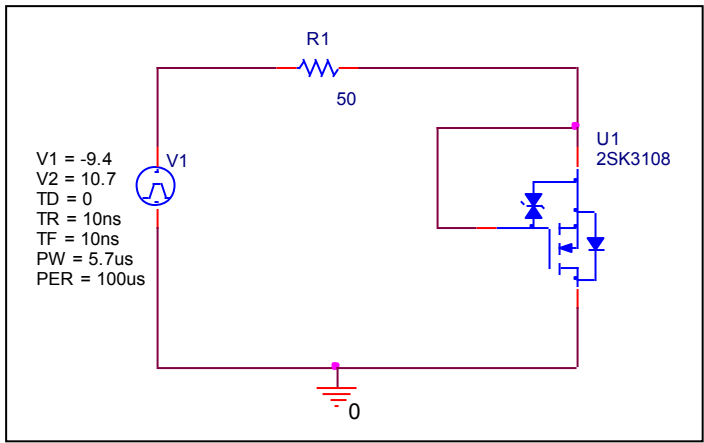
I_{SD} (A)	VSD(V)		%Error
	Measurement	Simulation	
0.1	0.700	0.700	-0.043
0.2	0.720	0.720	-0.056
0.5	0.750	0.752	0.267
1	0.790	0.786	-0.506
2	0.830	0.833	0.361
5	0.930	0.928	-0.215
10	1.050	1.051	0.095

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

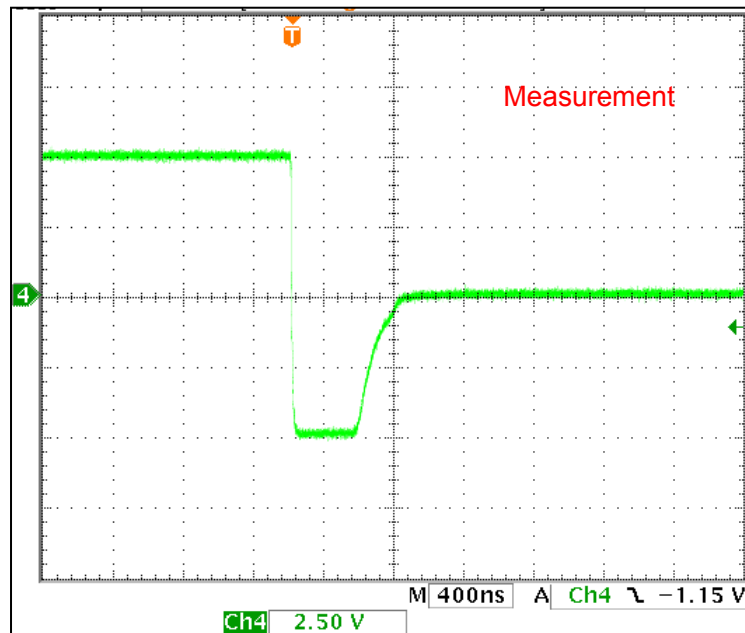


Comparison table

	Measurement	Simulation	Error (%)
trr	580.00	580.39	0.07

Reverse Recovery Characteristic

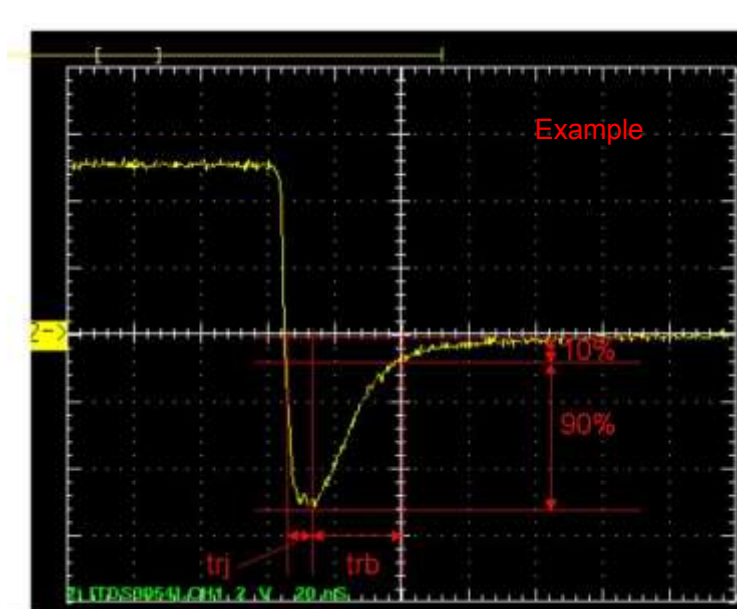
Reference



$T_{rr}=342(\text{ns})$

$T_{rb}=238(\text{ns})$

Conditions: $I_{fwd}=I_{rev}=0.2(\text{A})$, $R_l=50$

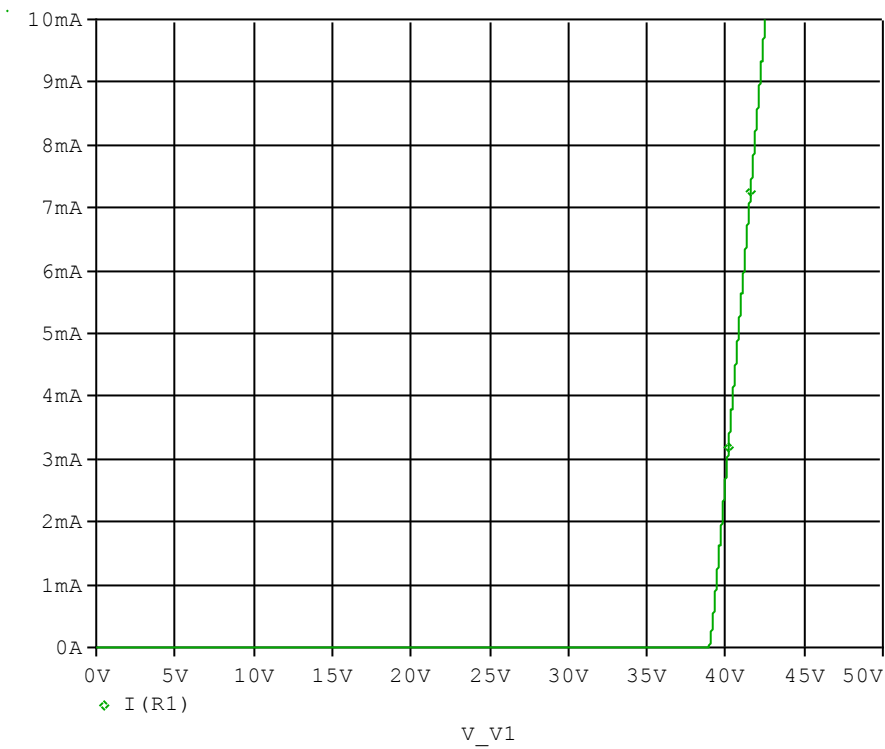


Relation between t_{rj} and t_{rb}

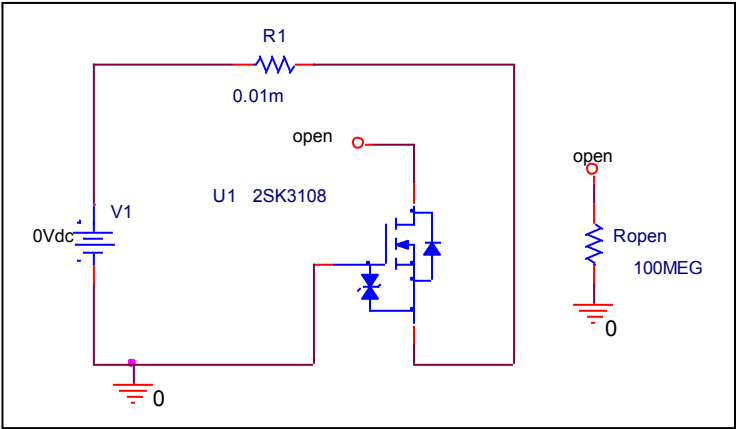
ESD PROTECTION DIODE

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic

Reference

