

Device Modeling Report

COMPONENTS: MOSFET (Model Parameters)
PART NUMBER: 2SK4064LS
MANUFACTURER: SANYO
REMARK: Body Diode (Model Parameters)



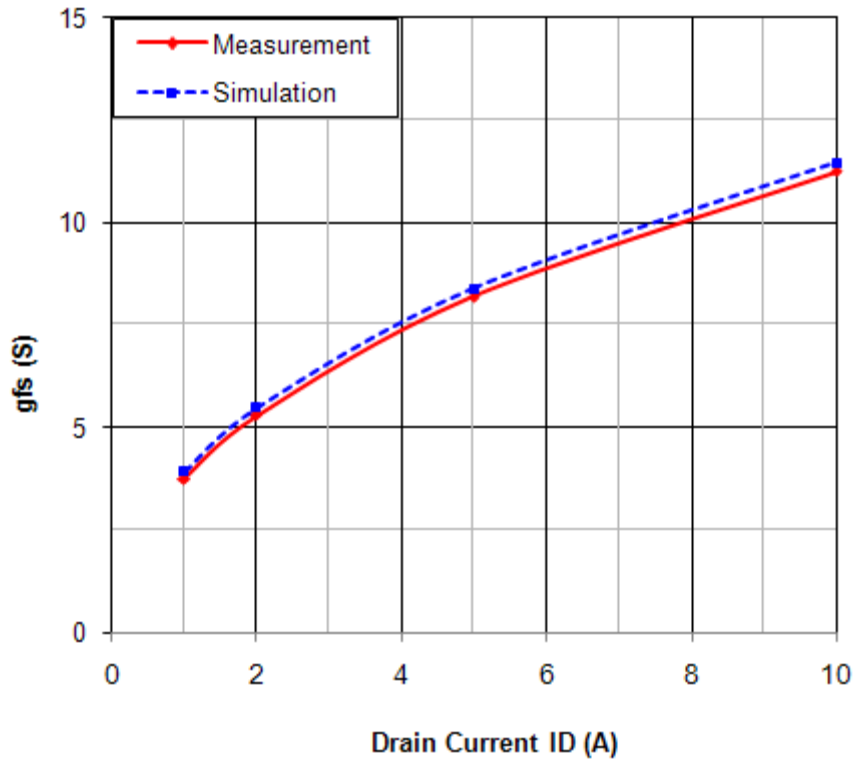
Bee Technologies Inc.

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

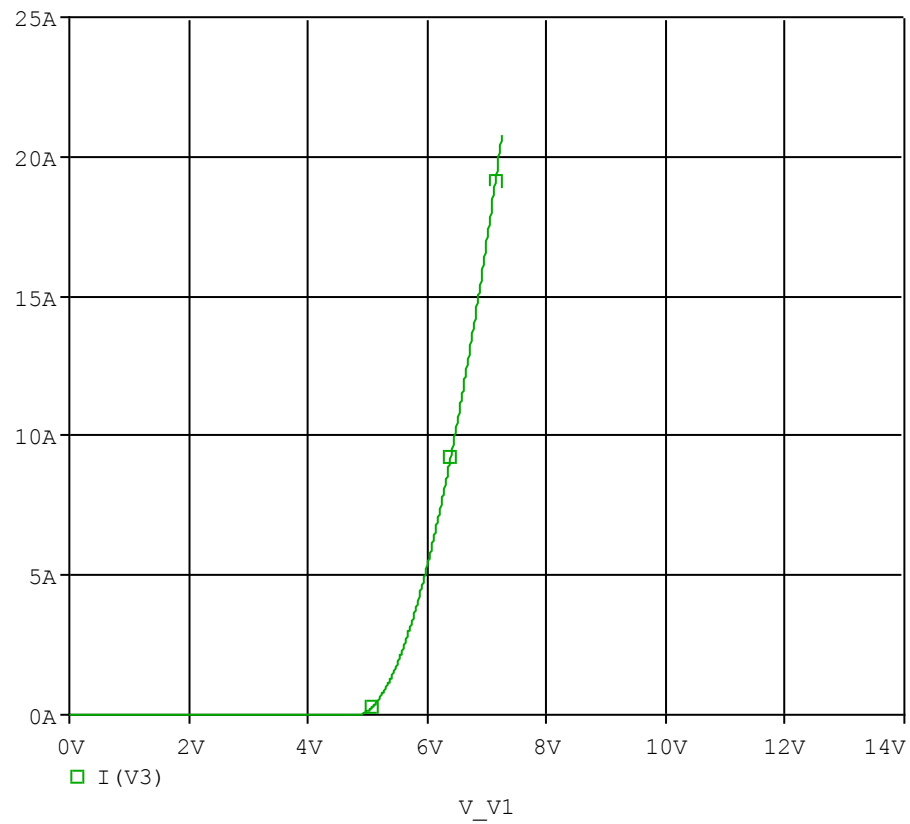


Comparison table

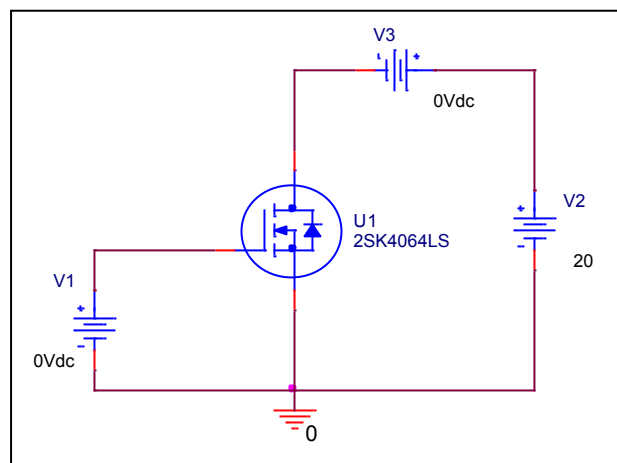
Id(A)	gfs (s)		Error (%)
	Measurement	Simulation	
1	3.750	3.933	4.88
2	5.300	5.473	3.26
5	8.200	8.388	2.29
10	11.250	11.465	1.91

V_{gs}-I_d Characteristic

Circuit Simulation result

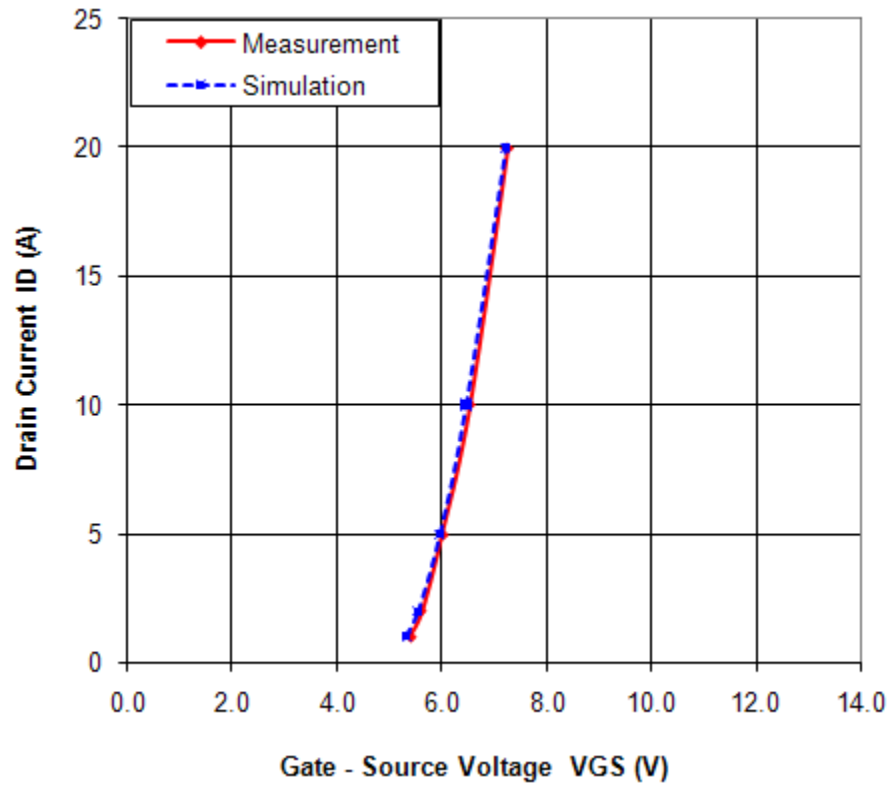


Evaluation circuit



Comparison Graph

Circuit Simulation Result

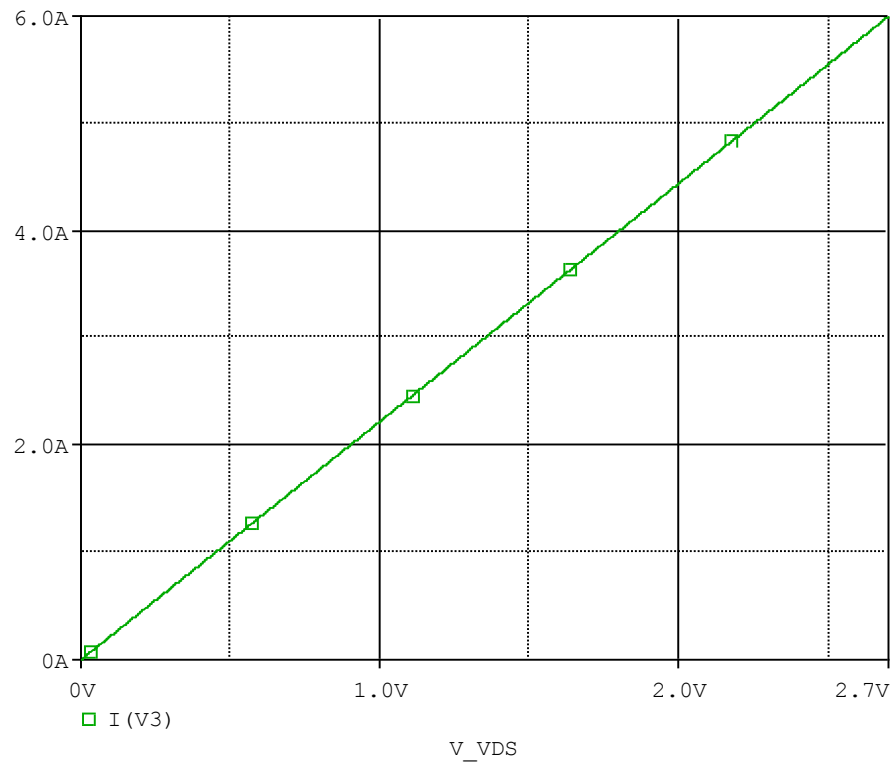


Simulation Result

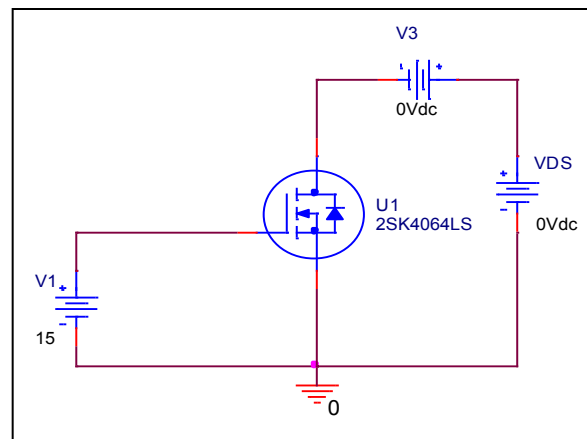
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
1	5.400	5.316	-1.556
2	5.600	5.528	-1.286
5	6.000	5.959	-0.683
10	6.525	6.462	-0.966
20	7.250	7.202	-0.662

R_{ds(on)} Characteristic

Circuit Simulation result



Evaluation circuit

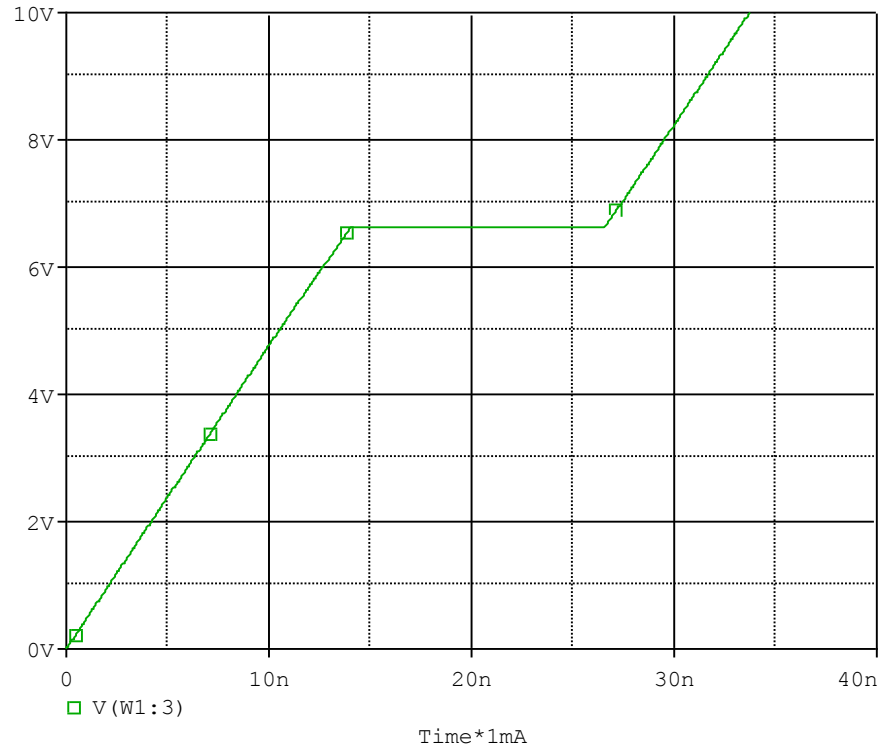


Simulation Result

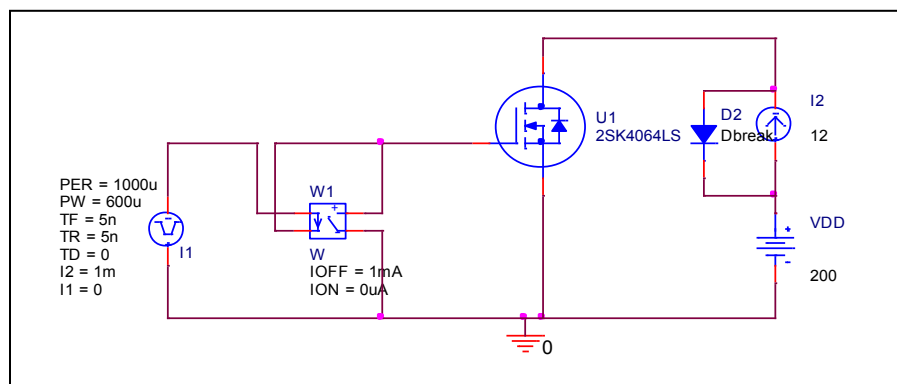
$I_D = 6A, V_{GS} = 15V$		Measurement	Simulation	Error (%)
$R_{DS(on)}$	Ω	0.450	0.450	0.067

Gate Charge Characteristic

Circuit Simulation result



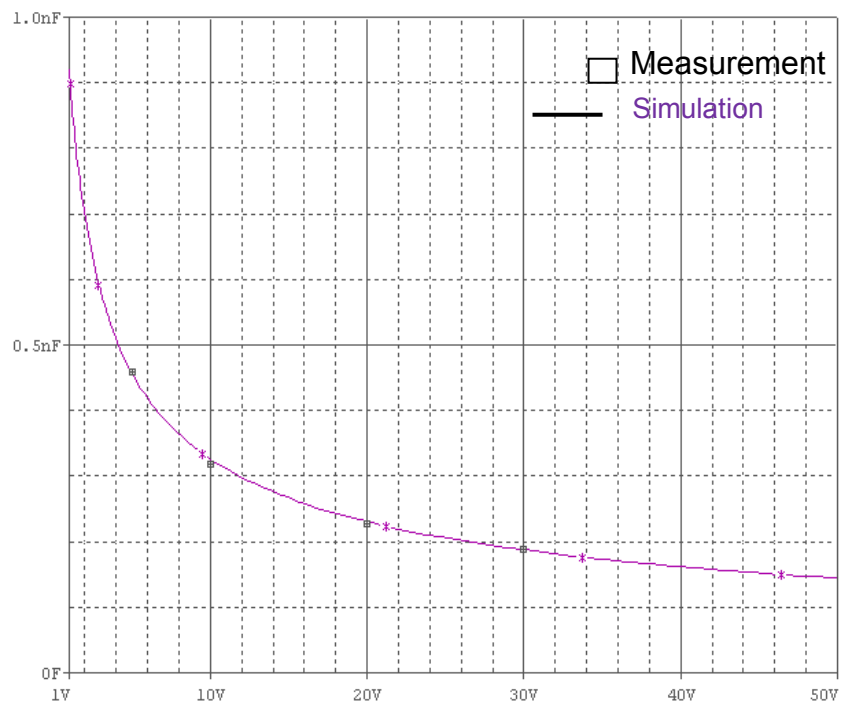
Evaluation circuit



Simulation Result

$V_{DD}=200V, I_D=12A, V_{GS}=10V$		Measurement	Simulation	Error (%)
Qgs	nC	14.000	14.044	0.314
Qgd	nC	12.500	12.562	0.496
Qg	nC	37.000	33.715	-8.878

Capacitance Characteristic

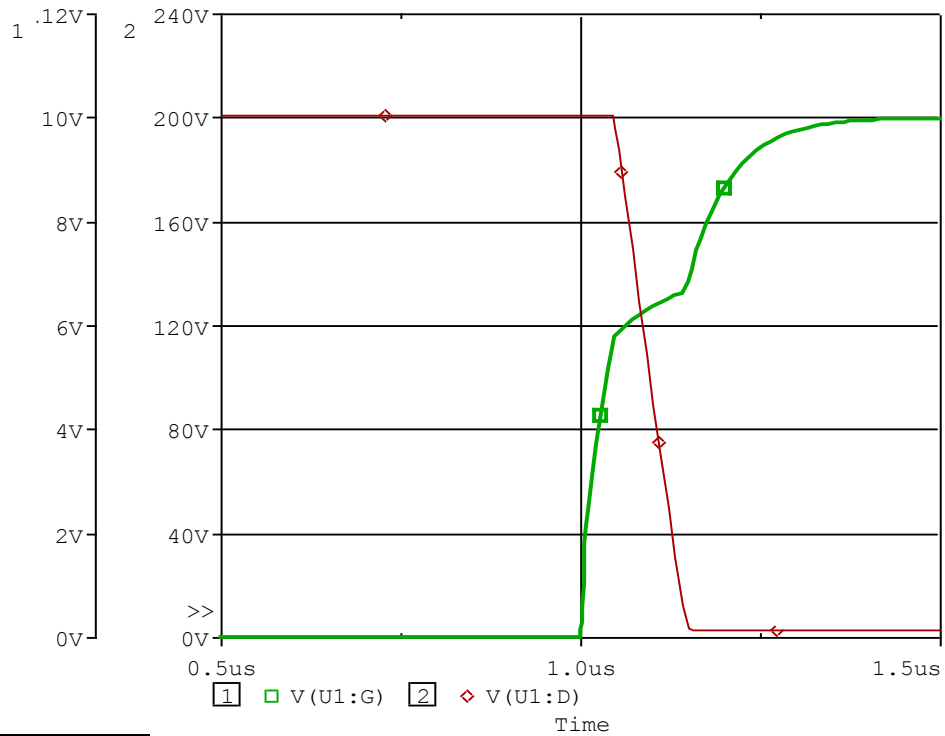


Simulation Result

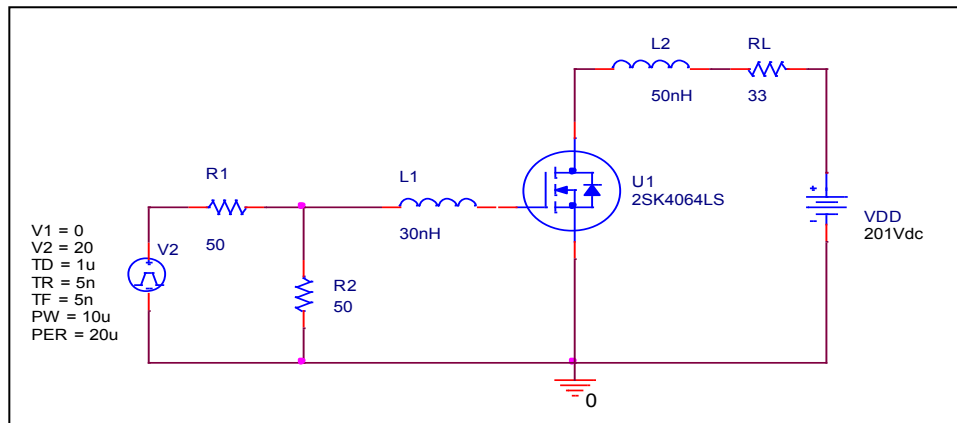
V _{DS} (V)	C _{bd} (pF)		Error (%)
	Measurement	Simulation	
5	460.00	458.000	-0.43
10	321.00	326.000	1.56
20	230.00	231.000	0.43
30	191.00	188.000	-1.57

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

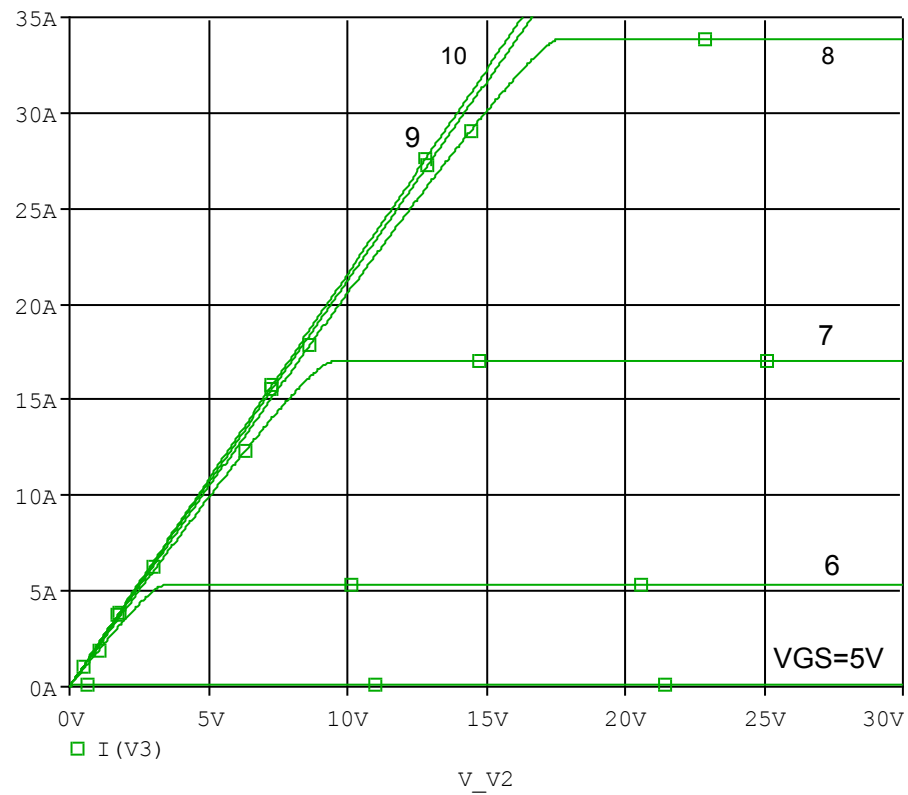


Simulation Result

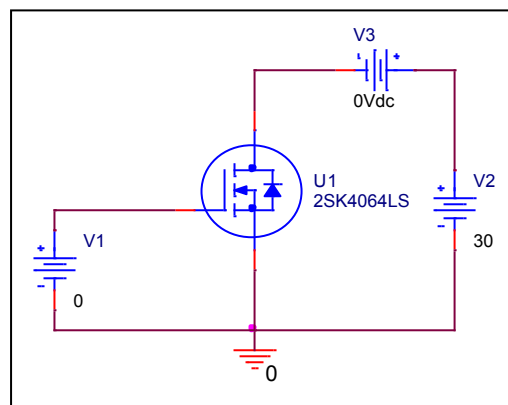
$I_D=6A$, $V_{DD}=200V$ $V_{GS}=0/10V$		Measurement	Simulation	Error (%)
td(on)	ns	52.000	52.091	0.175

Output Characteristic

Circuit Simulation result

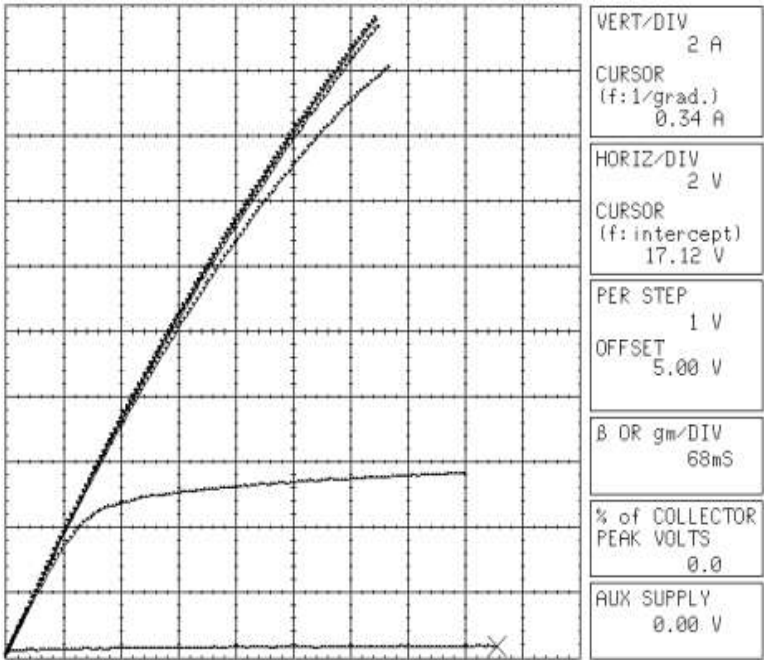


Evaluation circuit



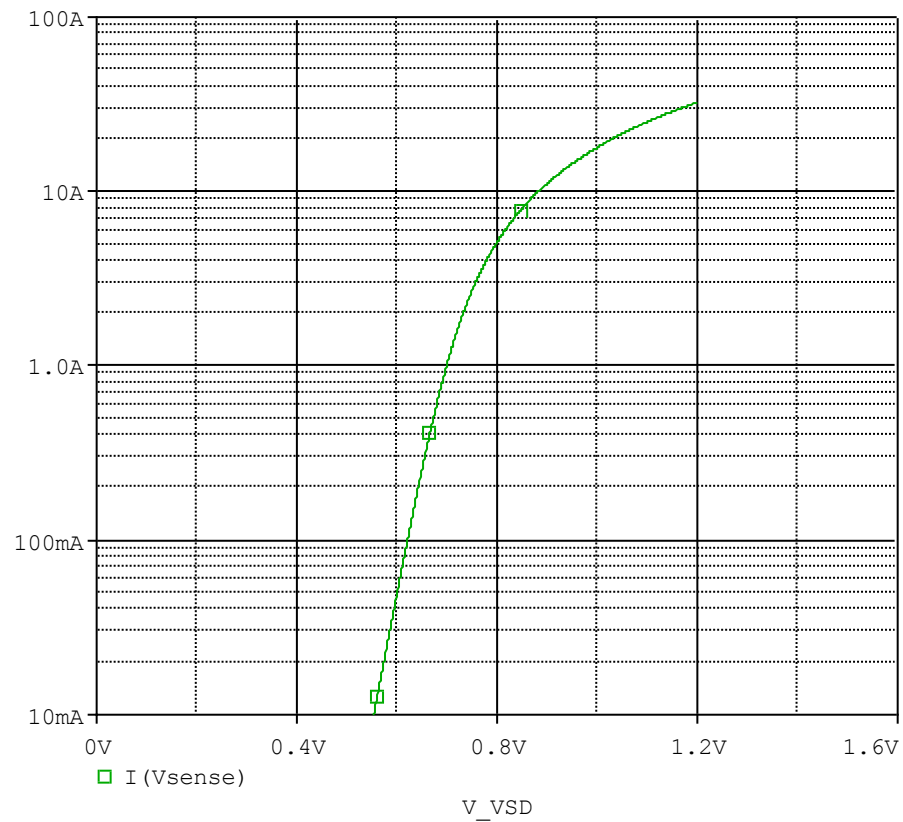
Output Characteristics

Reference

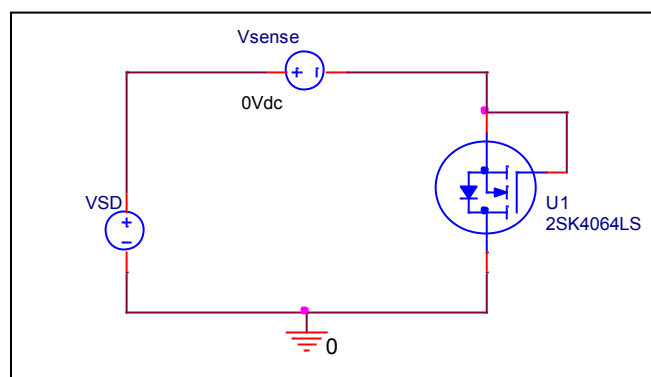


Forward Current Characteristic

Circuit Simulation Result

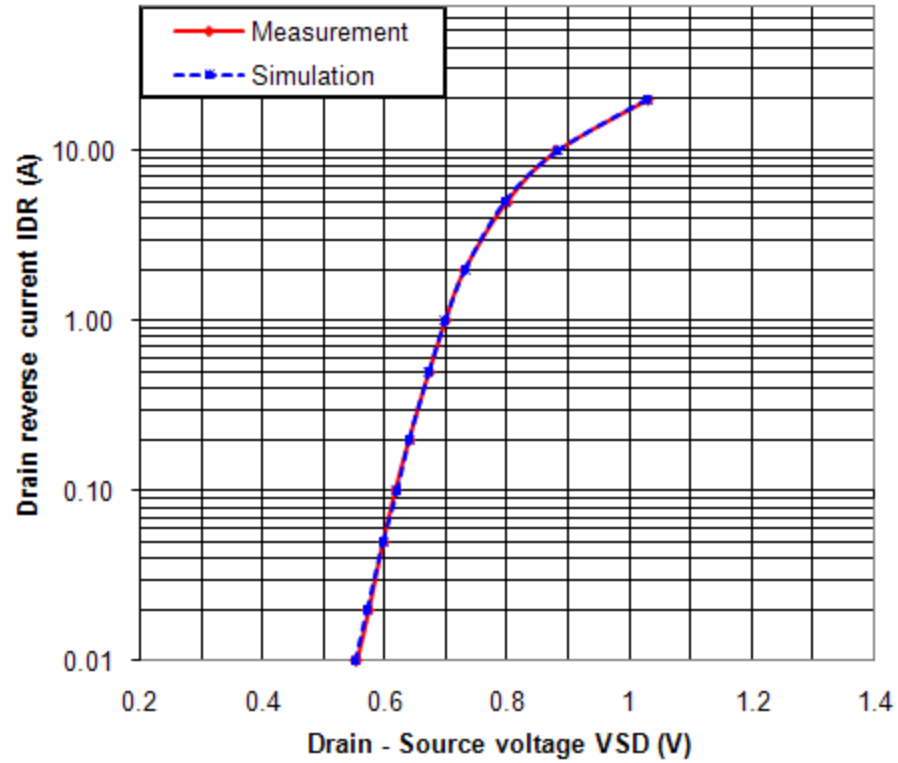


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

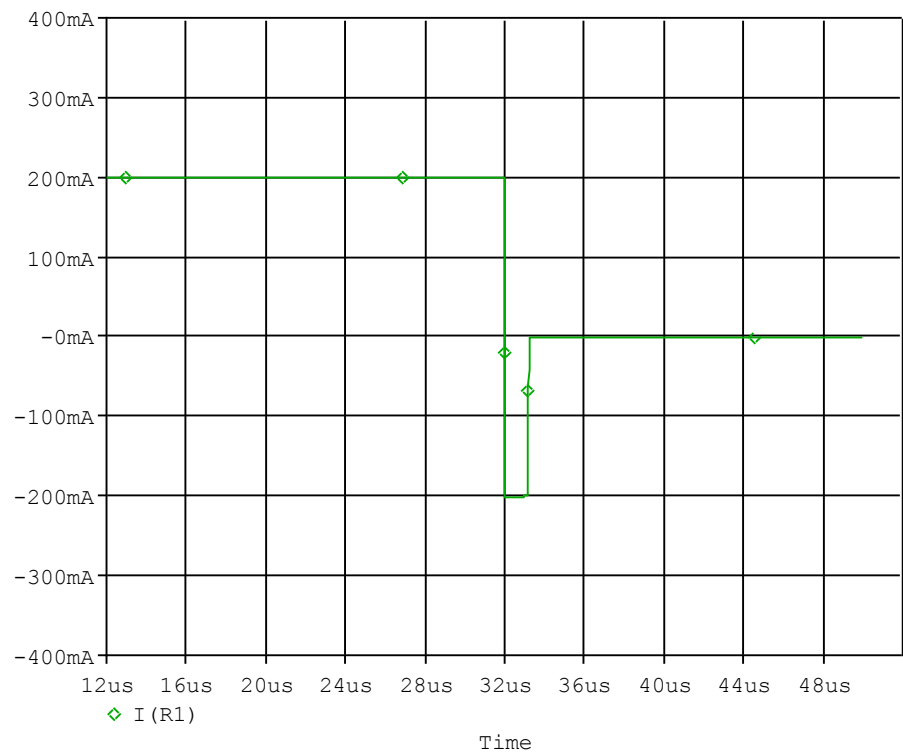


Simulation Result

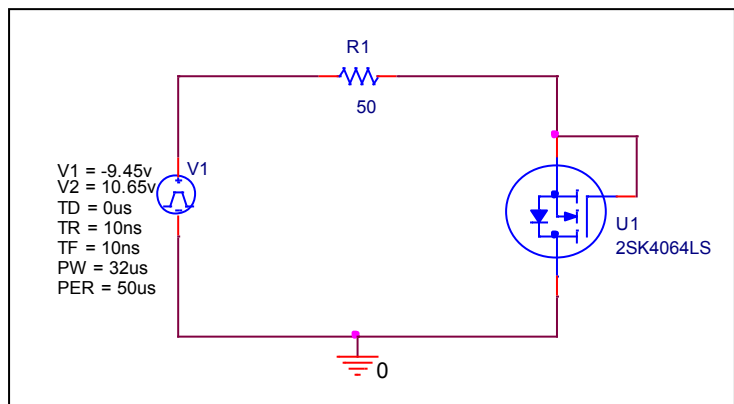
IDR(A)	VSD(V)		%Error
	Measurement	Simulation	
0.01	0.555	0.553	-0.36
0.02	0.574	0.573	-0.17
0.05	0.598	0.599	0.17
0.10	0.618	0.620	0.32
0.20	0.640	0.641	0.16
0.50	0.674	0.672	-0.30
1.00	0.700	0.698	-0.29
2.00	0.730	0.732	0.27
5.00	0.800	0.797	-0.38
10.00	0.880	0.882	0.23
20.00	1.030	1.029	-0.10

Reverse Recovery Characteristics

Circuit Simulation Result



Evaluation Circuit

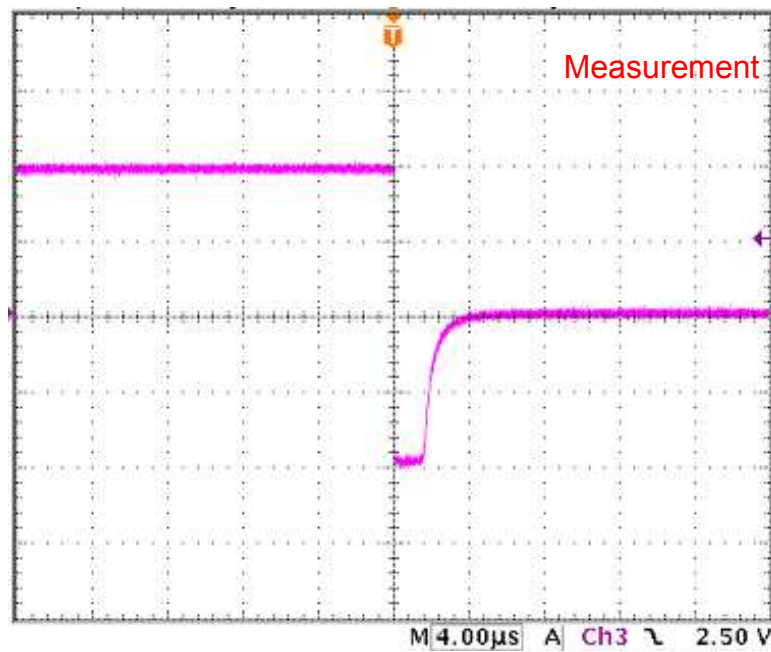


Compare Measurement vs. Simulation

		Measurement	Simulation	Error (%)
trj	us	1.040	1.038	-0.22

Reverse Recovery Characteristic

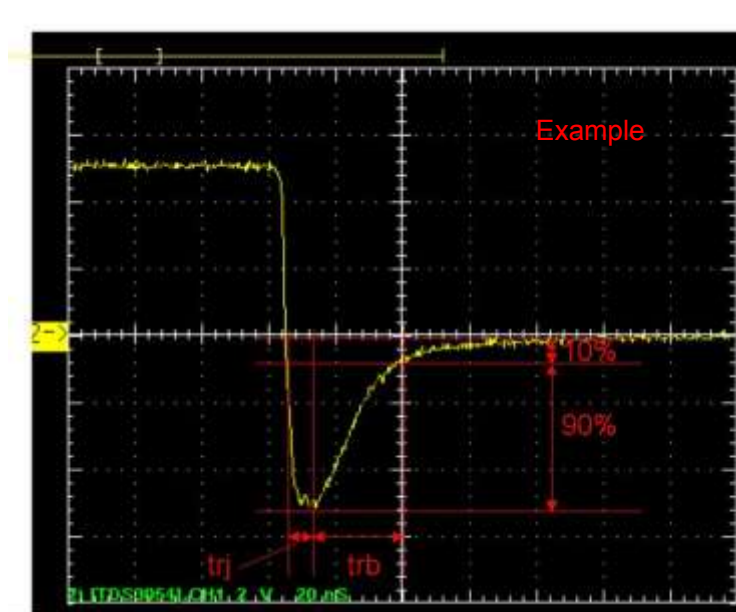
Reference



$T_{rj} = 1.04 \text{ (}\mu\text{s)}$

$T_{rb} = 1.44 \text{ (}\mu\text{s)}$

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



Relation between t_{rj} and t_{rb}