

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPC6104
MANUFACTURER: TOSHIBA
Body Diode (Professional) / ESD Protection Diode

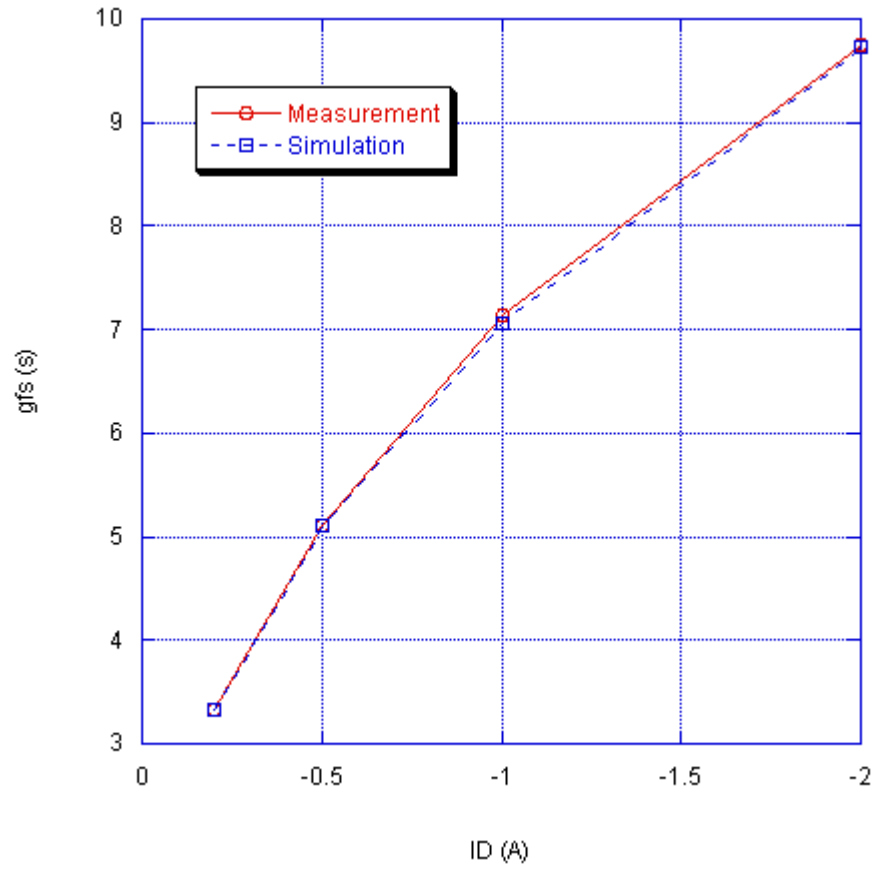


MOSFET MODEL

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

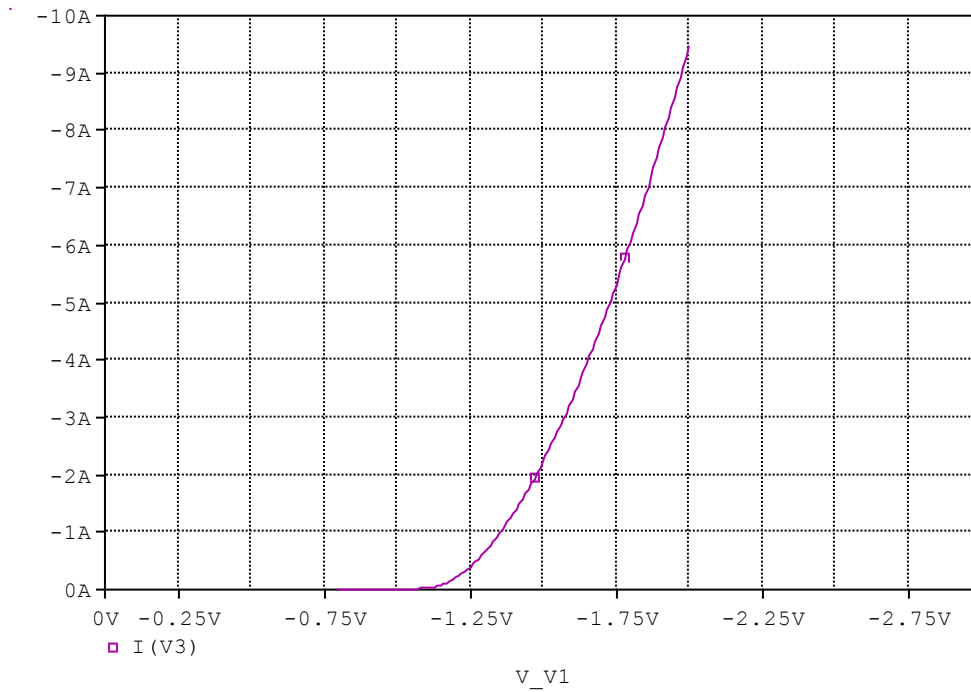


Simulation Result

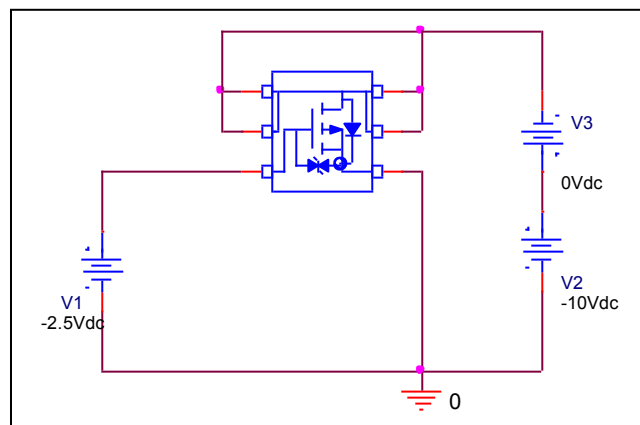
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
-0.200	3.333	3.335	0.060
-0.500	5.100	5.113	0.255
-1.000	7.143	7.063	-1.120
-2.000	9.756	9.723	-0.338

V_{gs}-I_d Characteristic

Circuit Simulation result

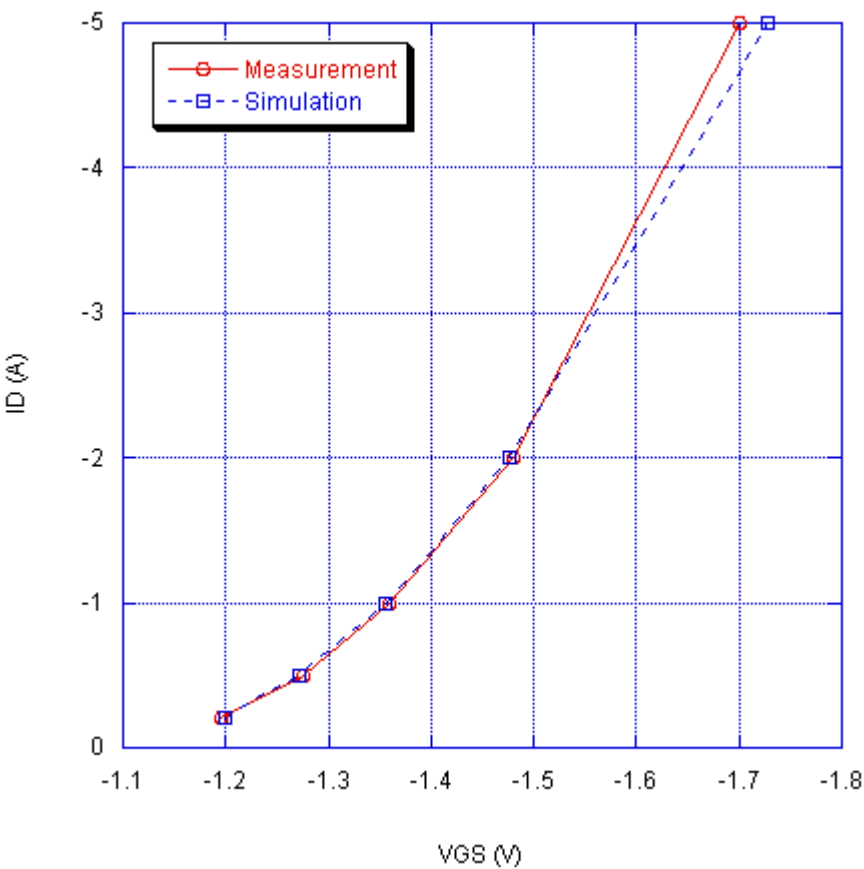


Evaluation circuit



Comparison Graph

Circuit Simulation Result

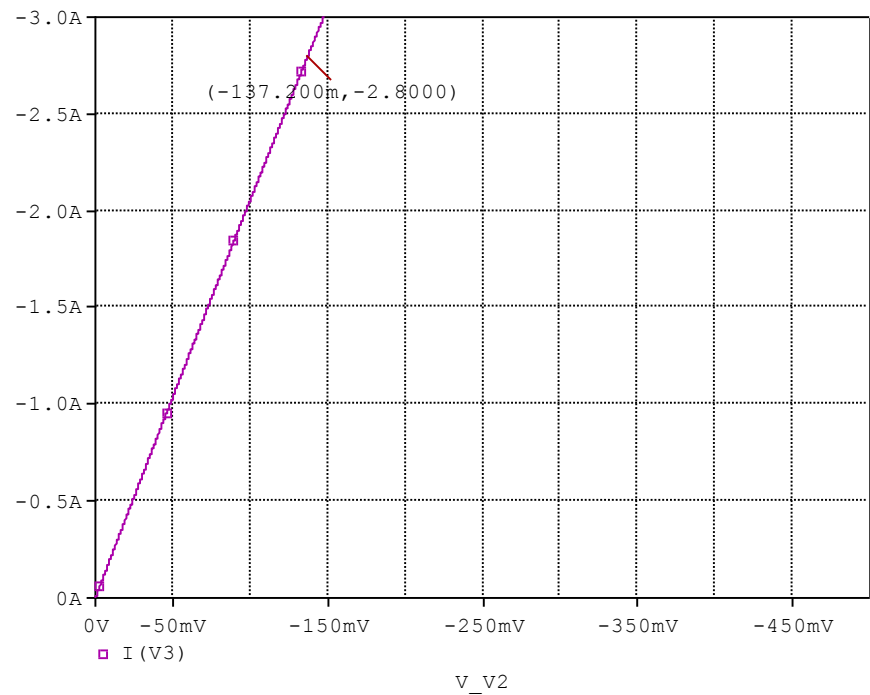


Simulation Result

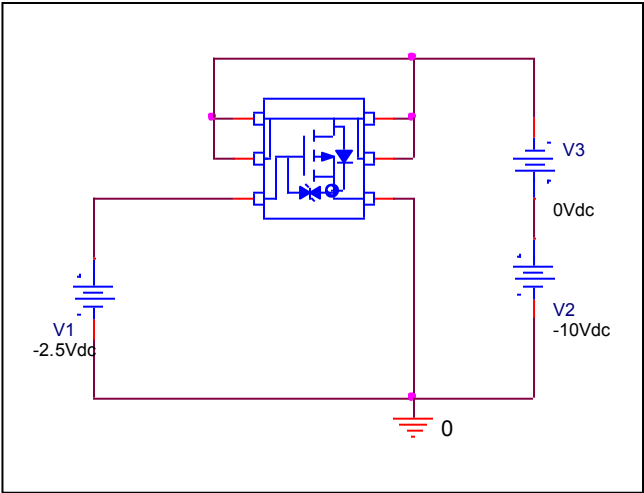
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
-0.200	-1.195	-1.199	0.360
-0.500	-1.275	-1.272	-0.227
-1.000	-1.360	-1.356	-0.309
-2.000	-1.480	-1.477	-0.189
-5.000	-1.700	-1.728	1.671

Id-Rds(on) Characteristic

Circuit Simulation result



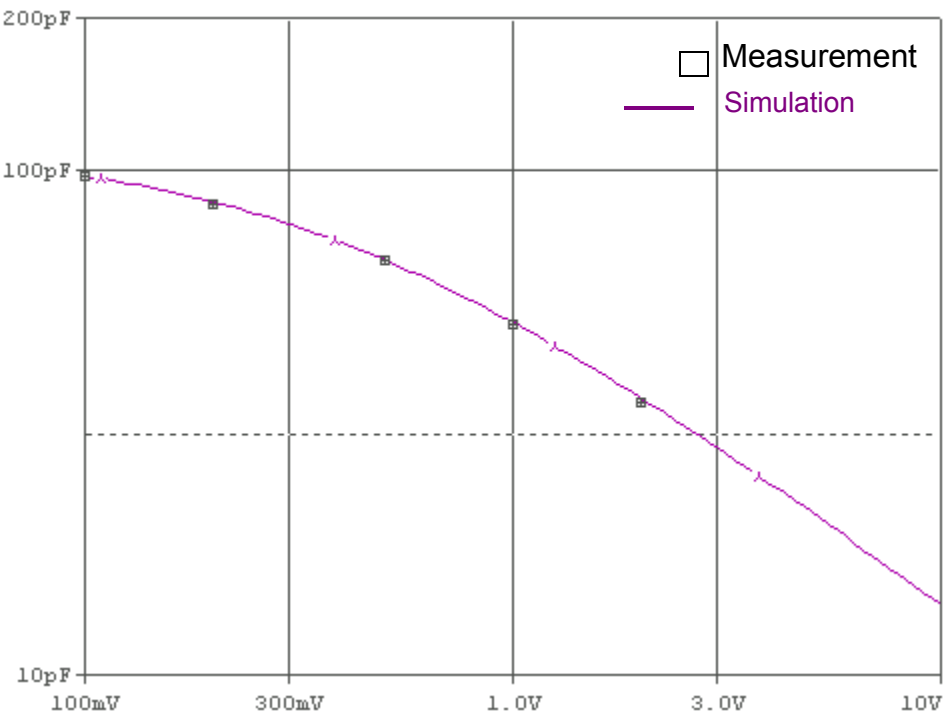
Evaluation circuit



Simulation Result

$I_D = -2.8, V_{GS} = -2.5V$	Measurement		Simulation		Error (%)
$R_{DS} (on)$	49	mΩ	49	mΩ	0

Capacitance Characteristic

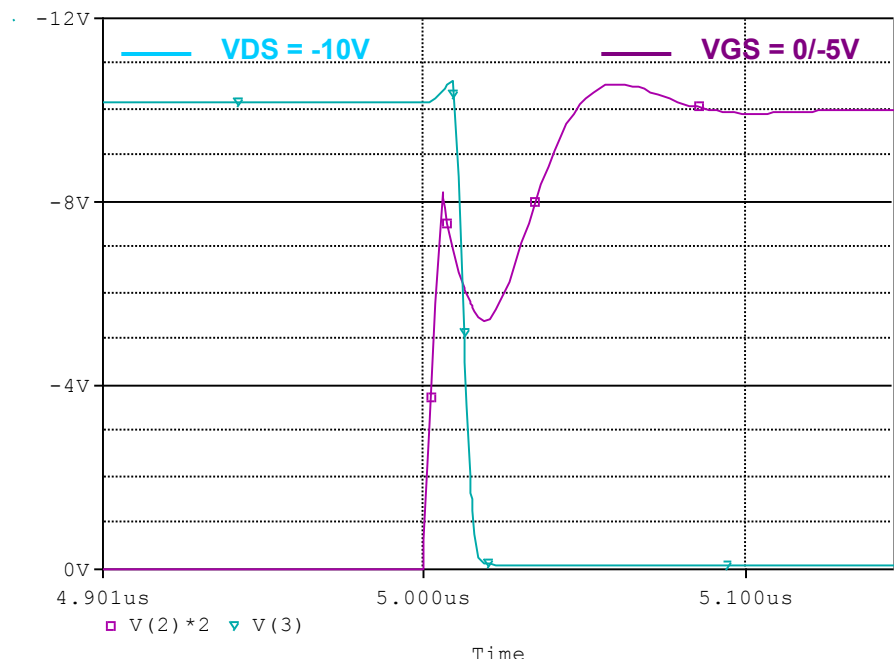


Simulation Result

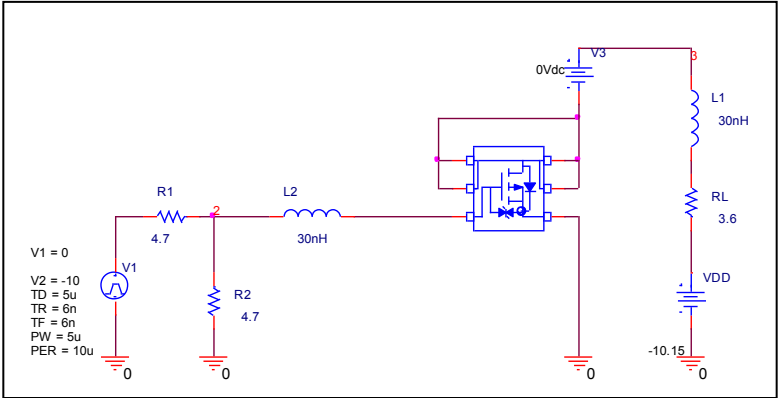
V _{DS} (V)	Cbd(pF)		Error(%)
	Measurement	Simulation	
0.1	98.0	97.2	-0.8
0.2	86.0	86.2	0.2
0.5	67.0	66.7	-0.4
1.0	50.0	50.0	0.0
2.0	35.0	35.1	0.3

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

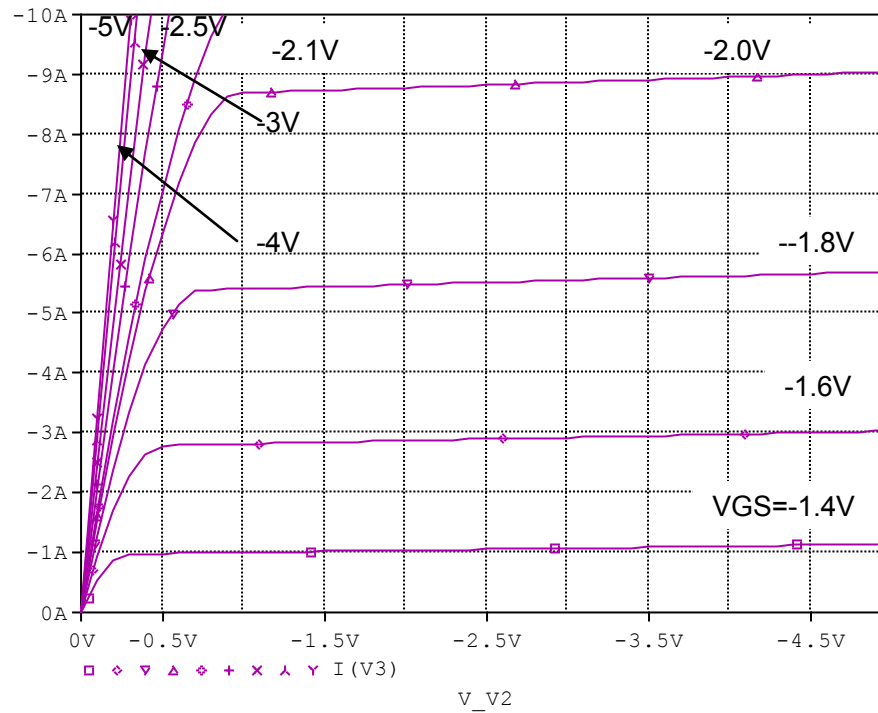


Simulation Result

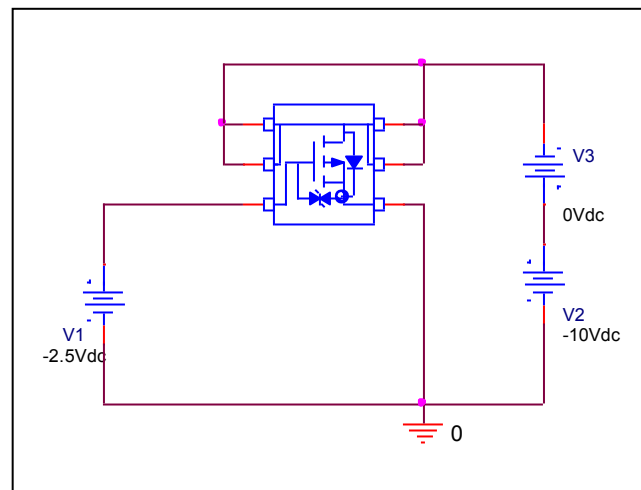
$I_D = -2.8A$, $V_{DD} = -10V$ $V_{GS} = 0/-5V$	Measurement		Simulation		Error(%)
	ton	15.000 ns	15.027 ns	ns	

Output Characteristic

Circuit Simulation result

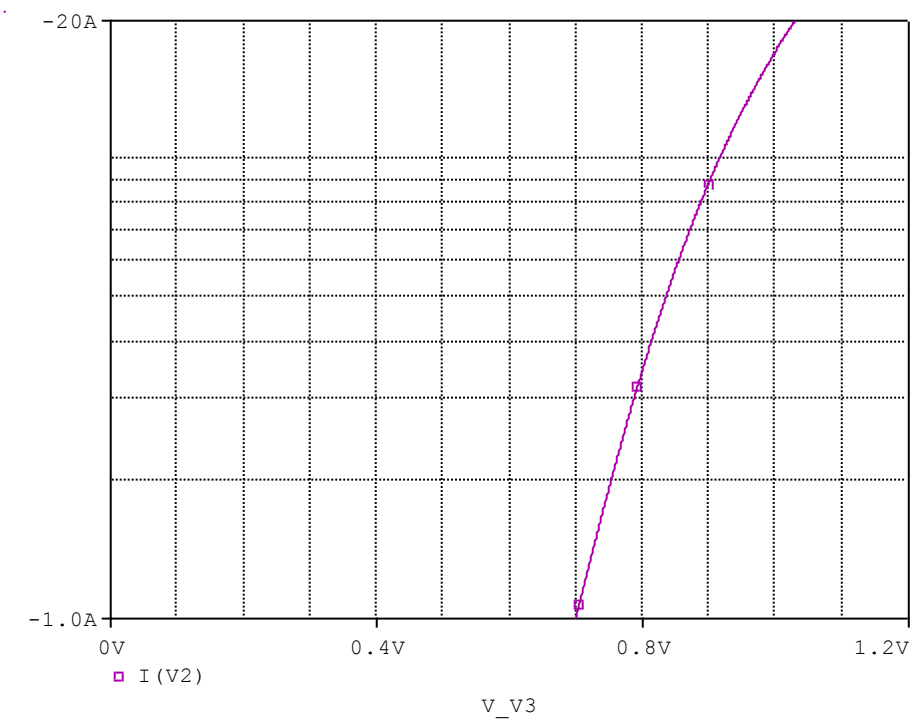


Evaluation circuit

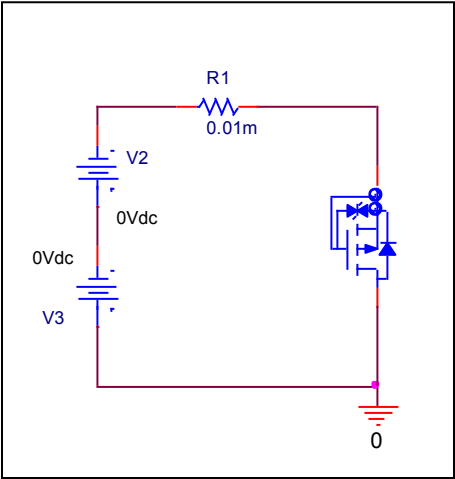


Forward Current Characteristic

Circuit Simulation Result

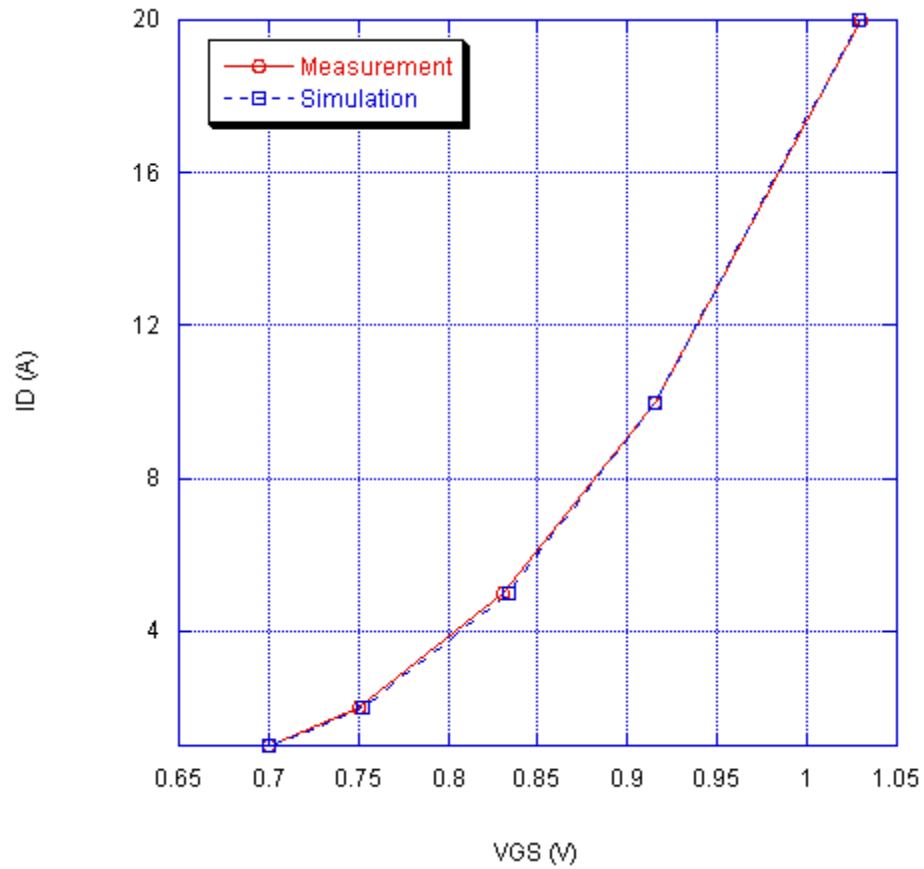


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

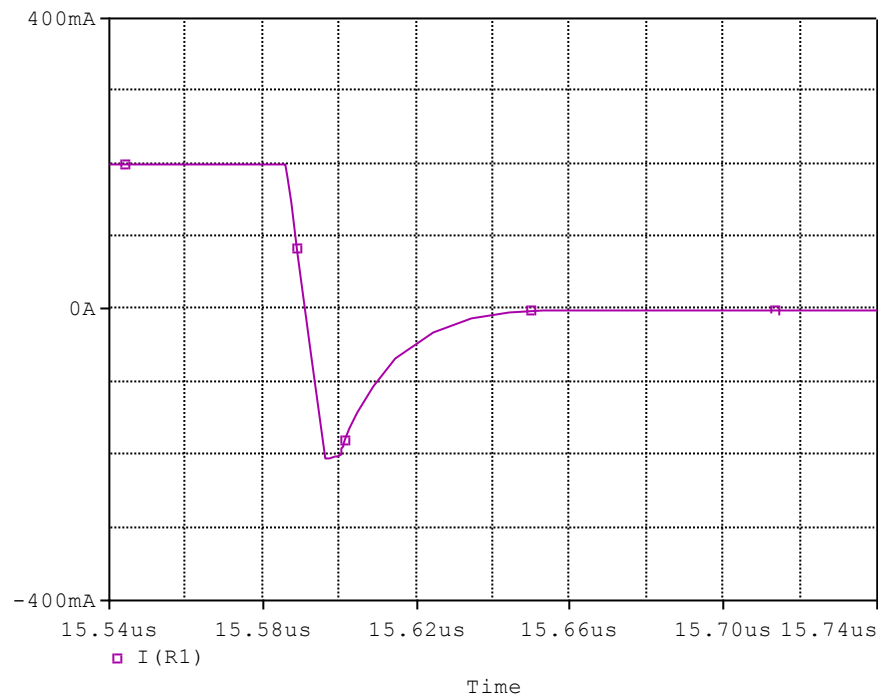


Simulation Result

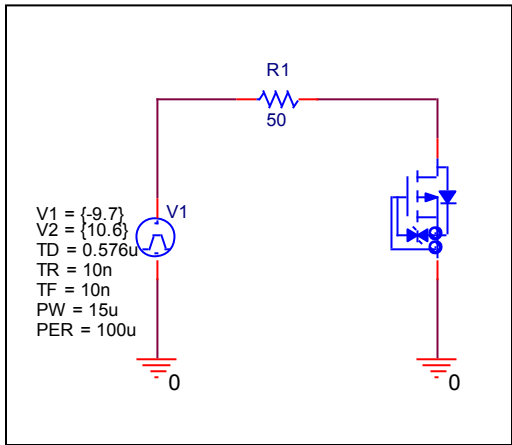
Ifwd(A)	Vfwd(V) Measurement	Vfwd(V) Simulation	%Error
1.000	0.700	0.700	-0.071
2.000	0.750	0.753	0.360
5.000	0.830	0.834	0.530
10.000	0.915	0.915	-0.033
20.000	1.030	1.029	-0.087

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

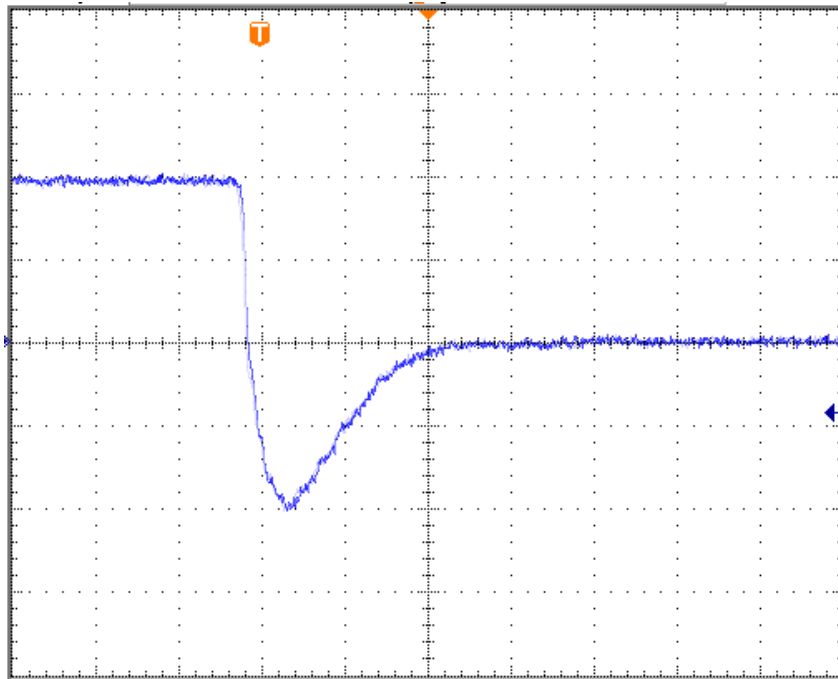


Compare Measurement vs. Simulation

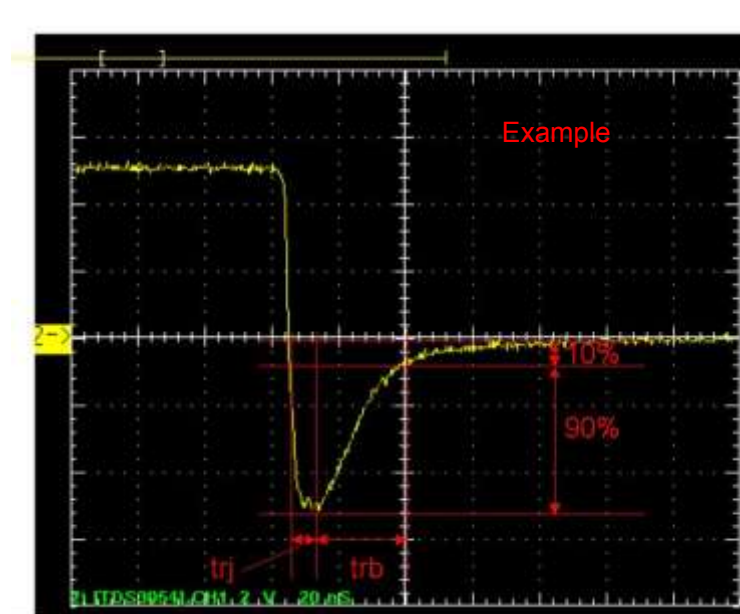
	Measurement		Simulation		Error(%)
trj	8.00	ns	7.93	ns	-0.875
trb	31.20	ns	31.31	ns	0.353
trr	39.20	ns	39.24	ns	0.102

Reverse Recovery Characteristic

Reference



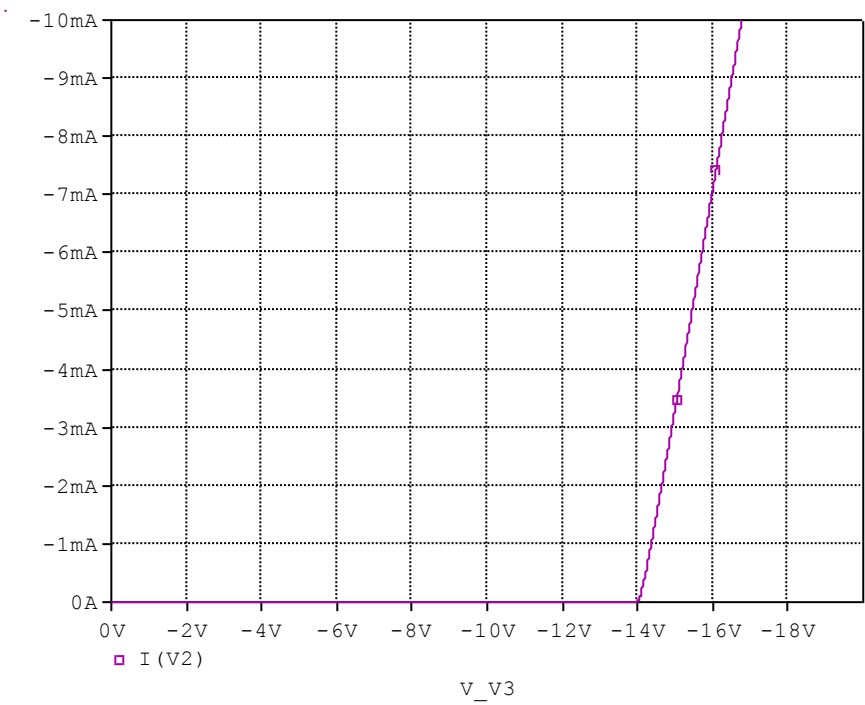
$t_{rj}=8.0(\text{ns})$
 $t_{rb}=31.2(\text{ns})$
Conditions: $I_{fwd}=I_{rev}=0.2(\text{A})$, $R_I=50$



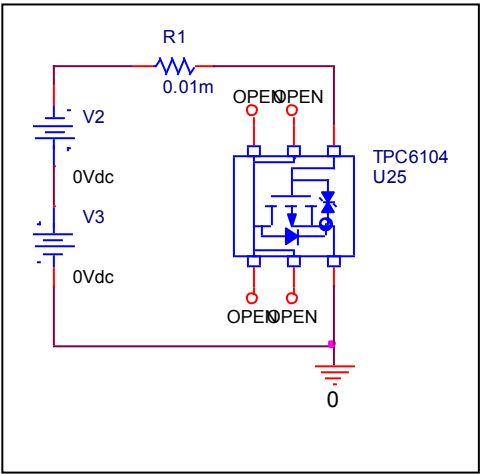
Relation between t_{rj} and t_{rb}

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic

Reference

