

Device Modeling Report

COMPONENTS: Power MOSFET (Professional)
PART NUMBER: TPC8A02-H
MANUFACTURER: TOSHIBA
Zener Diode (Special) / ESD Protection Diode



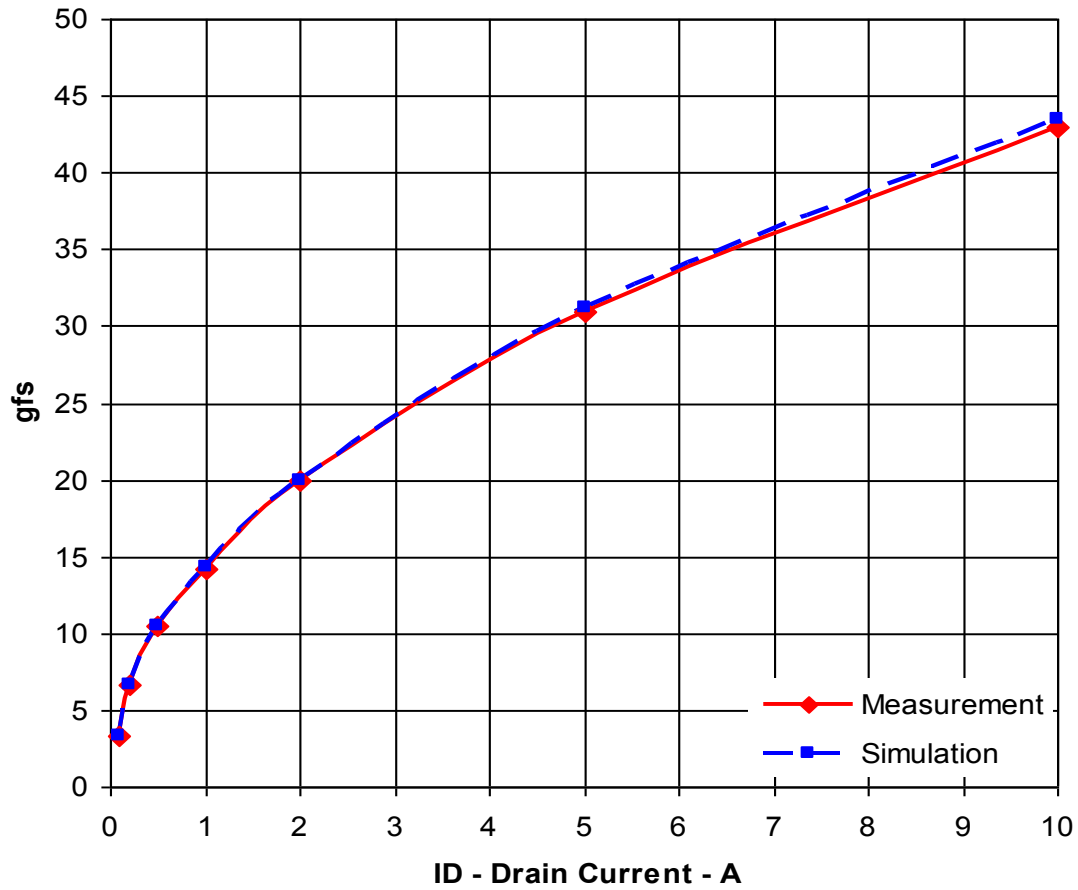
Bee Technologies Inc.

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

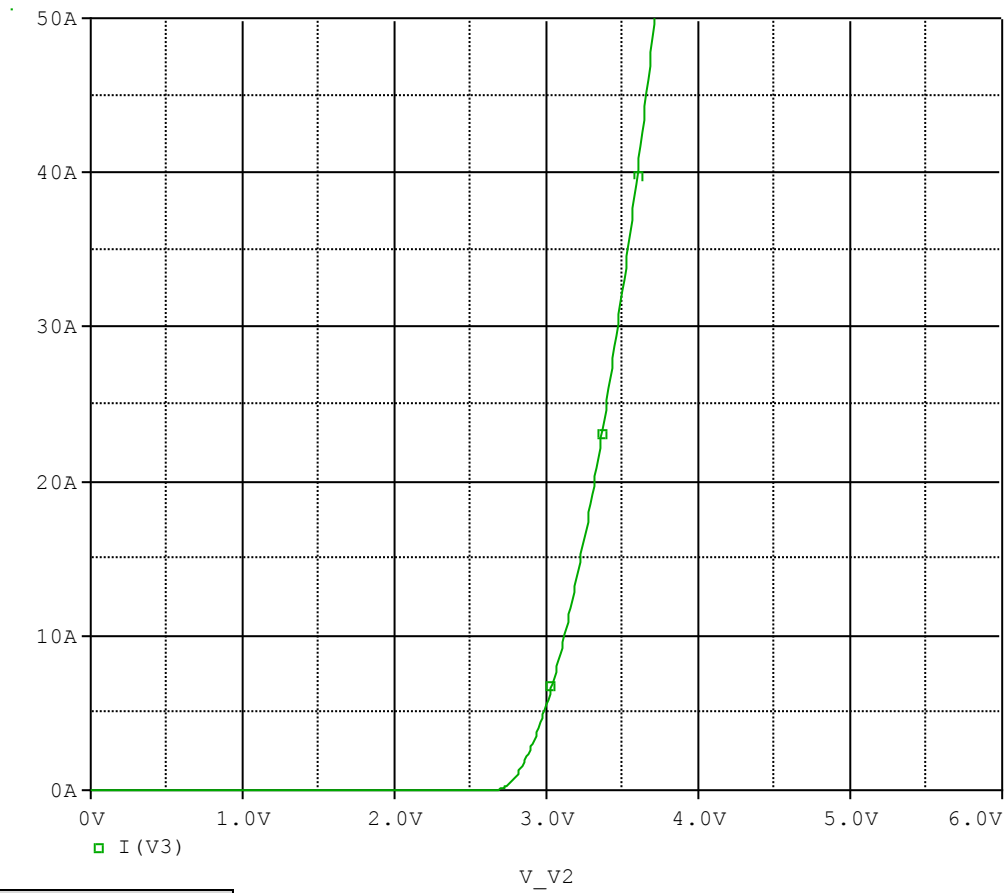


Comparison table

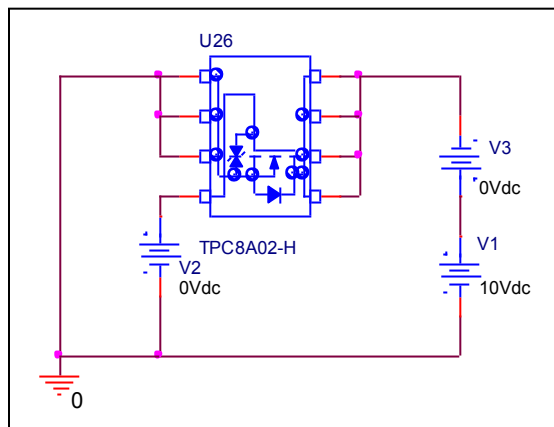
Id(A)	gfs		Error(%)
	Measurement	Simulation	
0.1	3.300	3.333	1.000
0.2	6.600	6.667	1.015
0.5	10.500	10.500	0.000
1	14.200	14.286	0.606
2	20.000	20.000	0.000
5	31.000	31.250	0.806
10	43.000	43.478	1.112

V_{gs}-I_d Characteristic

Circuit Simulation result

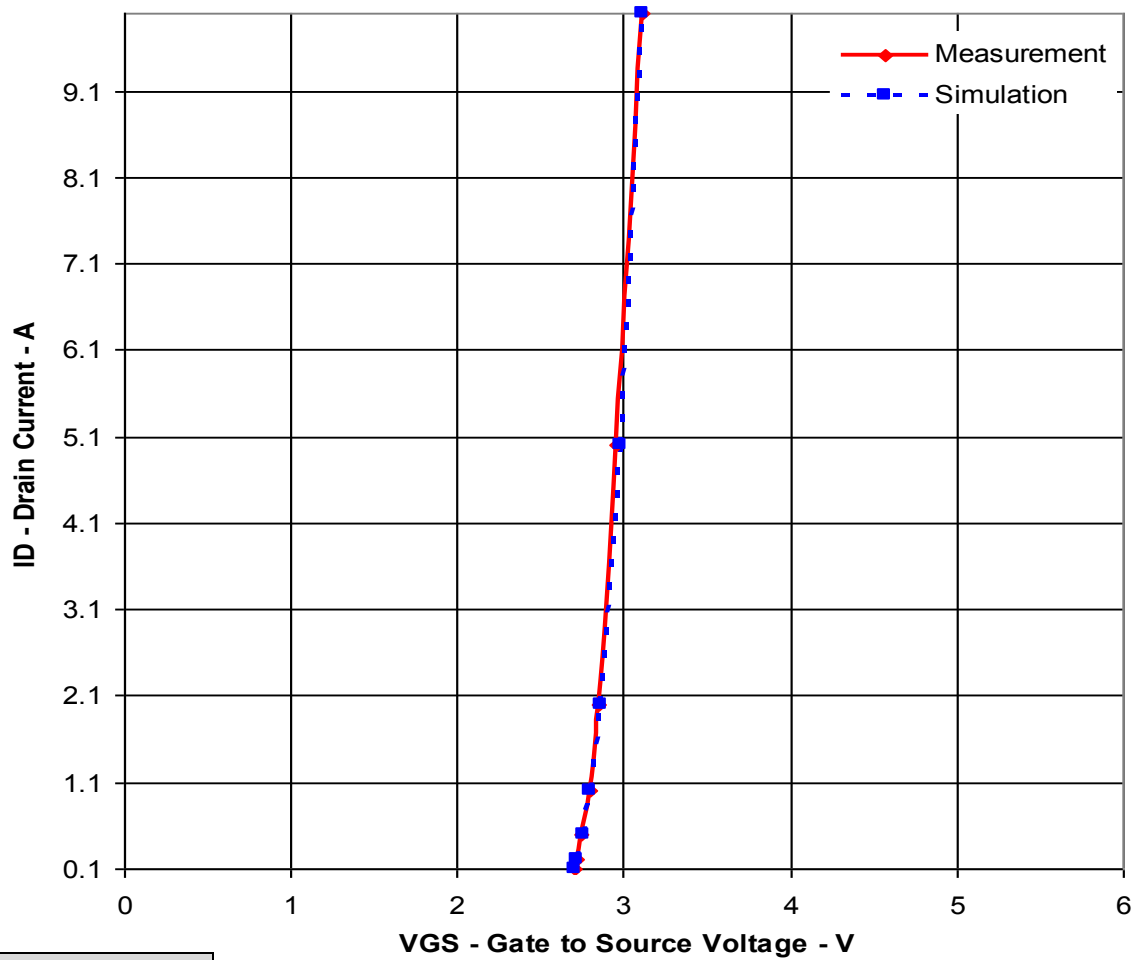


Evaluation circuit



Comparison Graph

Circuit Simulation Result

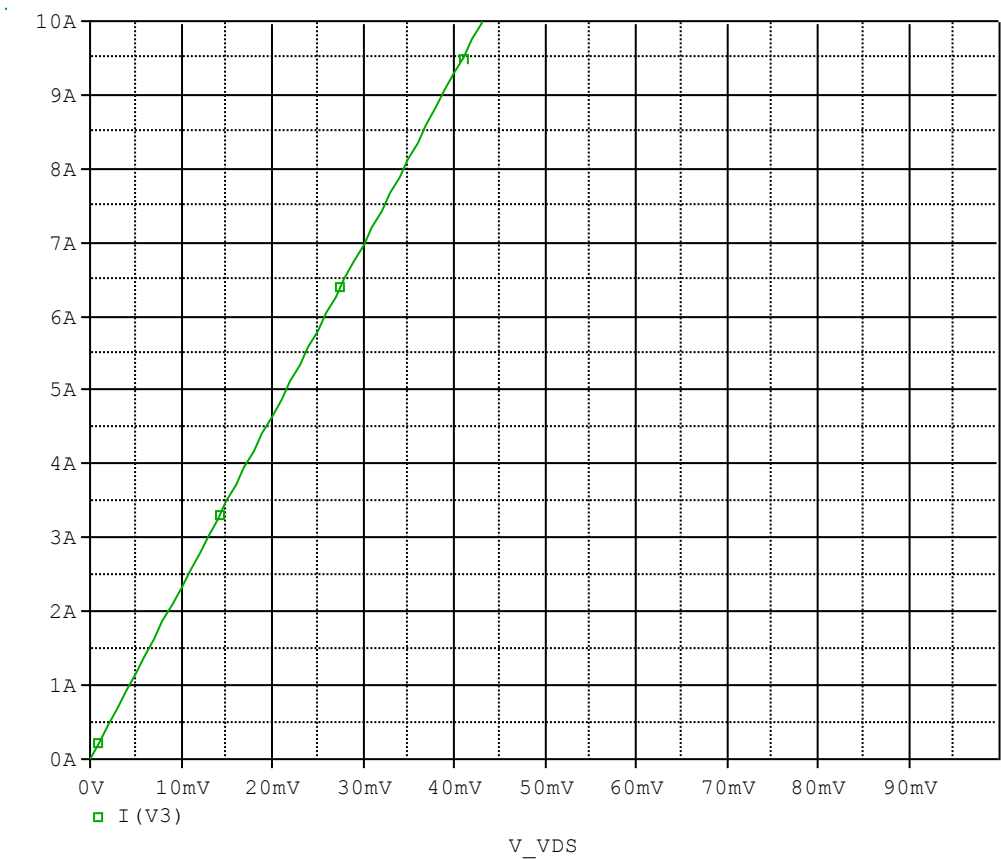


Simulation Result

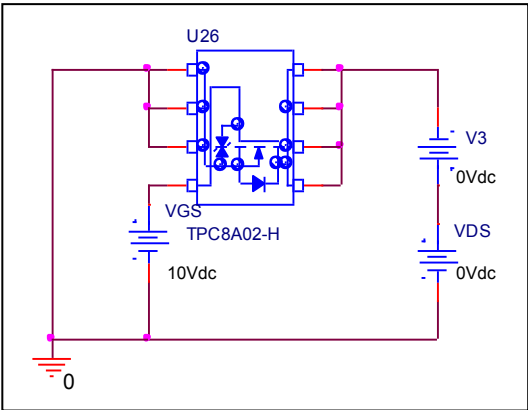
I_D (A)	V_{GS} (V)		Error (%)
	Measurement	Simulation	
0.1	2.700	2.704	0.148
0.2	2.720	2.723	0.110
0.5	2.750	2.761	0.400
1	2.800	2.803	0.107
2	2.850	2.863	0.456
5	2.950	2.982	1.085
10	3.110	3.118	0.257

Rds(on) Characteristic

Circuit Simulation result



Evaluation circuit

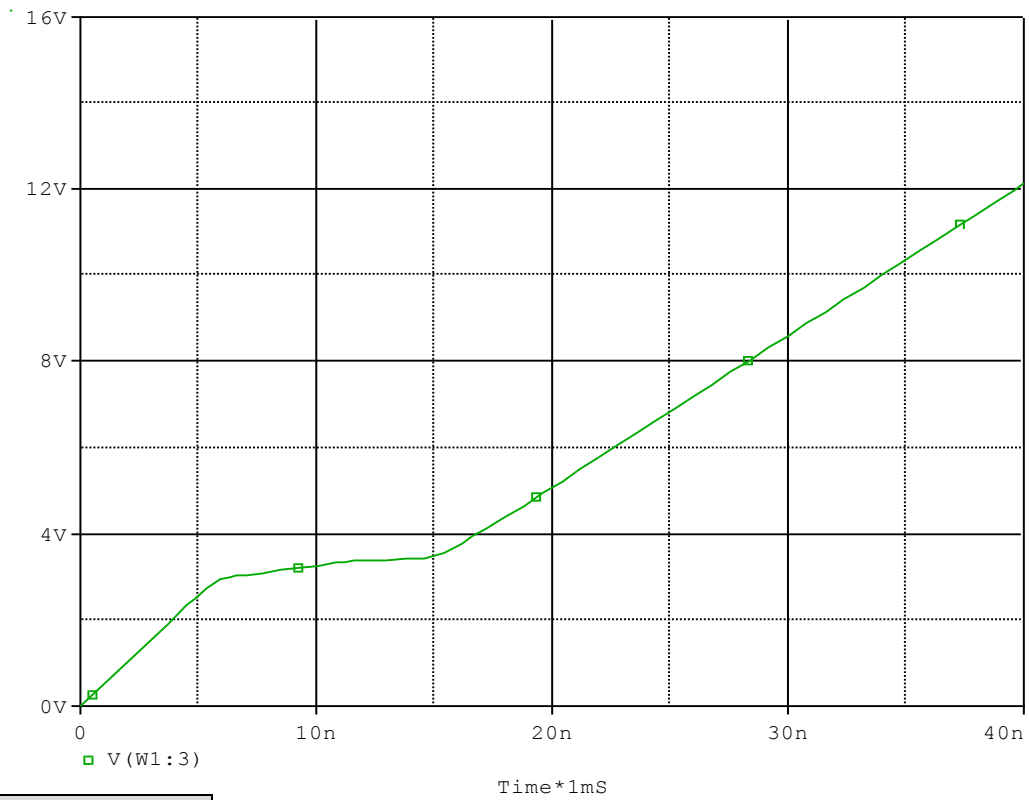


Simulation Result

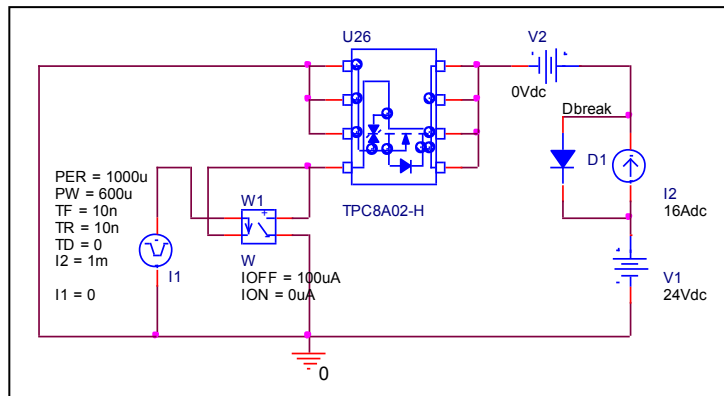
$I_D=8A, V_{GS}=10V$	Measurement		Simulation		Error (%)
$R_{DS} (on)$	4.3	Ω	4.302	Ω	0.047

Gate Charge Characteristic

Circuit Simulation result



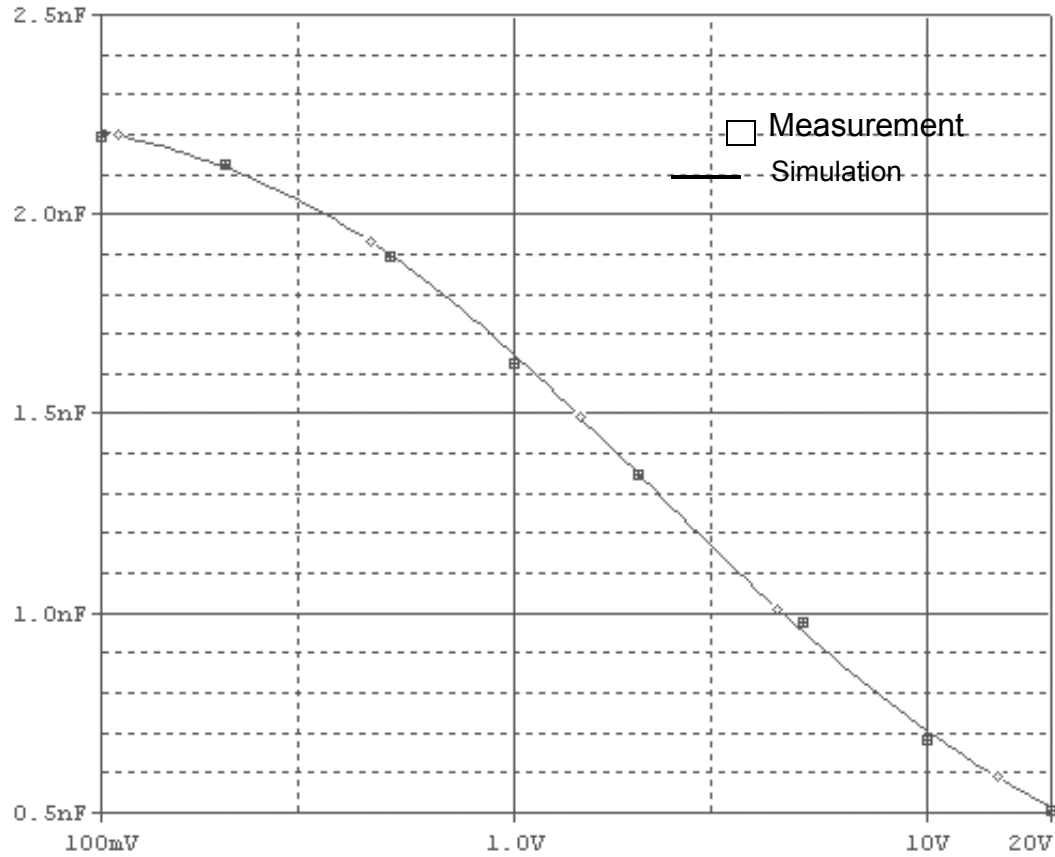
Evaluation circuit



Simulation Result

$V_{DD}=24V, I_D=16A$ $, V_{GS}=10V$	Measurement	Simulation	Error (%)
$Q_{gs}(nC)$	6.000	6.017	0.283
$Q_{gd}(nC)$	9.000	8.983	-0.189
Q_g	34.000	34.068	0.200

Capacitance Characteristic

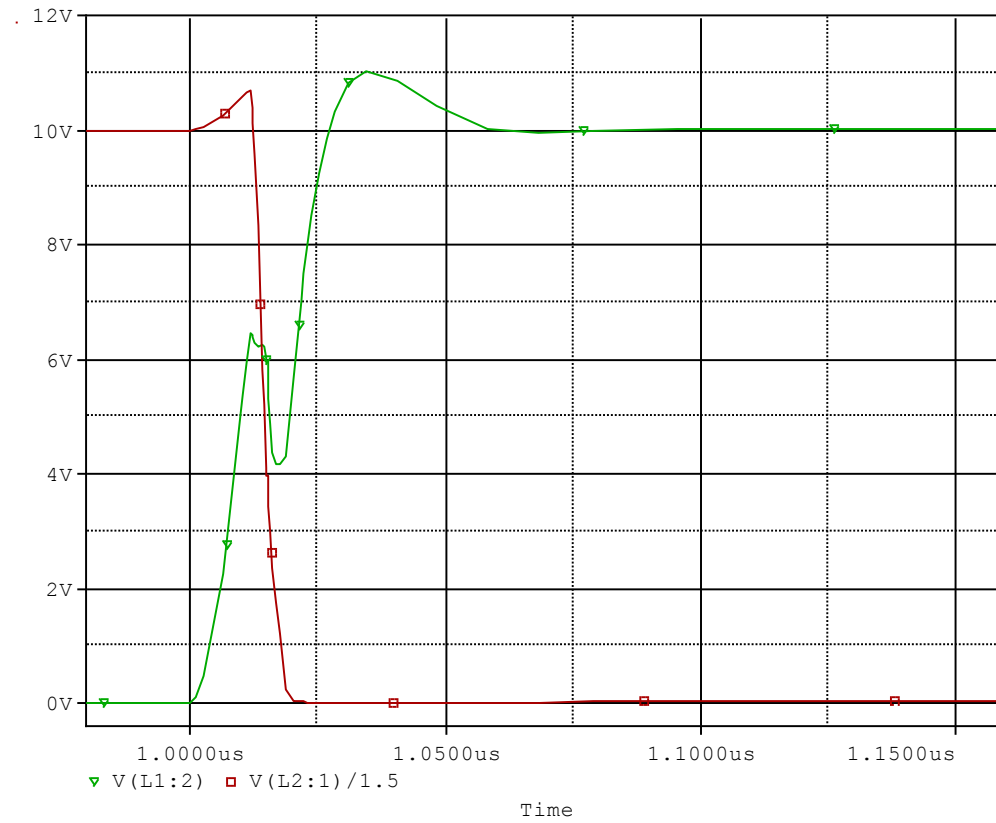


Simulation Result

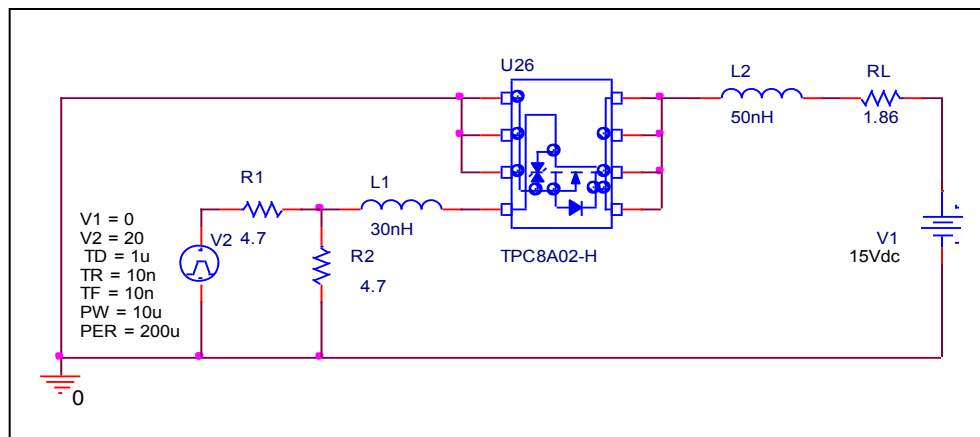
V_{DS} (V)	C_{bd} (nF)		Error(%)
	Measurement	Simulation	
0.1	2.200	2.210	0.455
0.2	2.130	2.100	-1.408
0.5	1.900	1.900	0.000
1	1.630	1.640	0.613
2	1.350	1.350	0.000
5	0.980	0.970	-1.020
10	0.690	0.700	1.449
20	0.510	0.515	0.980

Switching Time Characteristic

Circuit Simulation result



Evaluation circuit

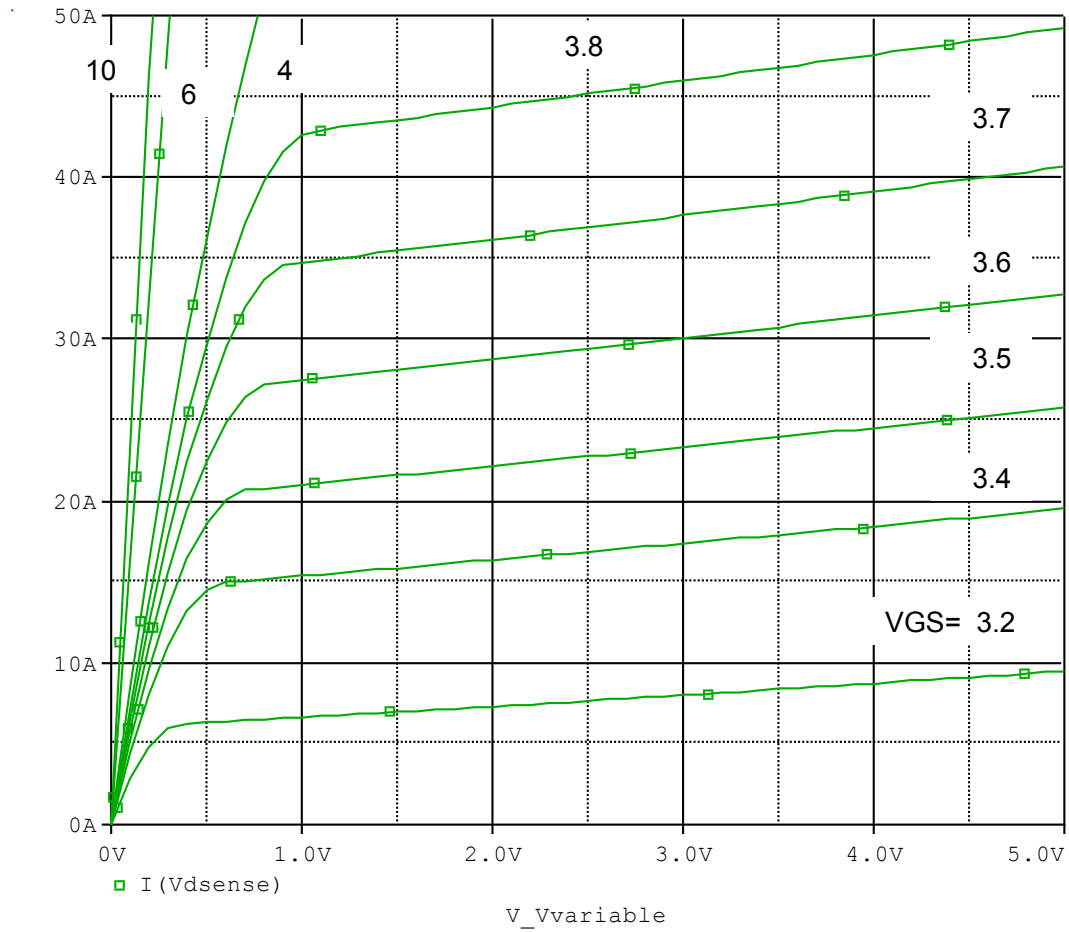


Simulation Result

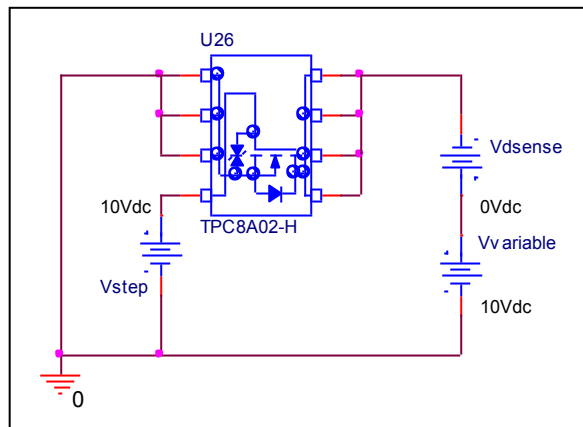
$I_D=8\text{ A}$, $V_{DD}=15\text{ V}$ $V_{GS}=0/10\text{ V}$	Measurement	Simulation	Error(%)
Ton(ns)	14.000	14.072	0.514

Output Characteristic

Circuit Simulation result

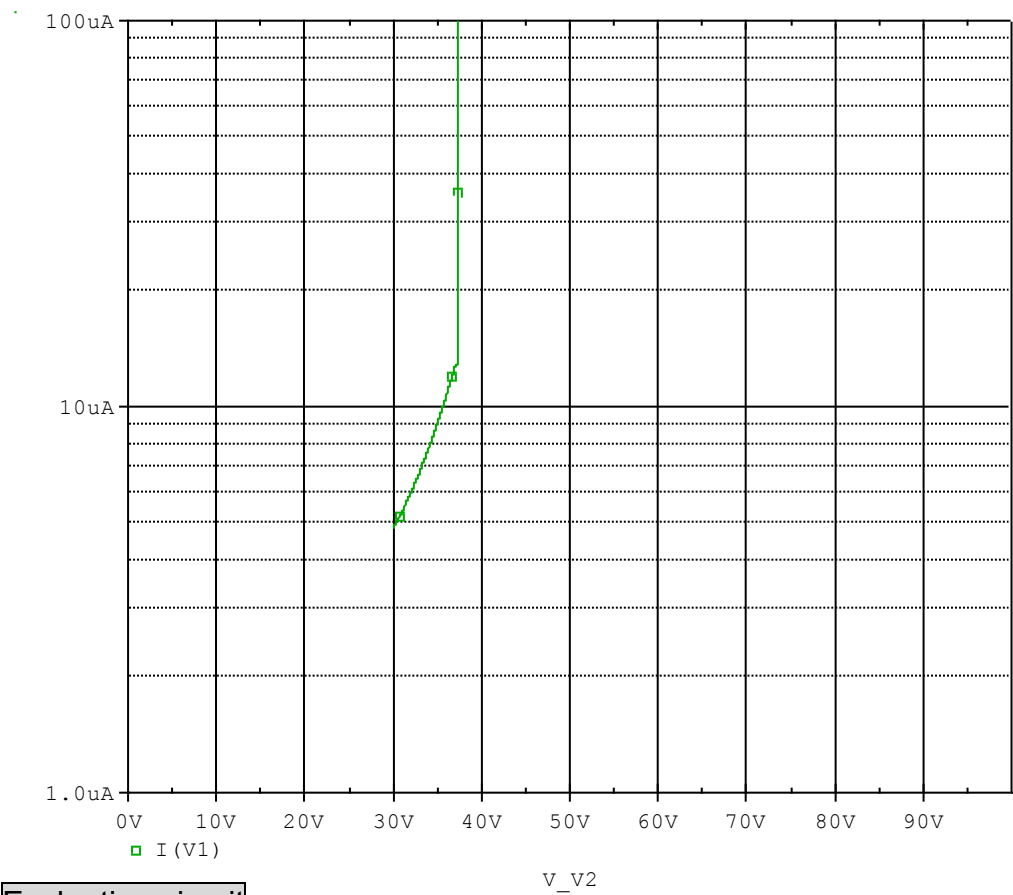


Evaluation circuit

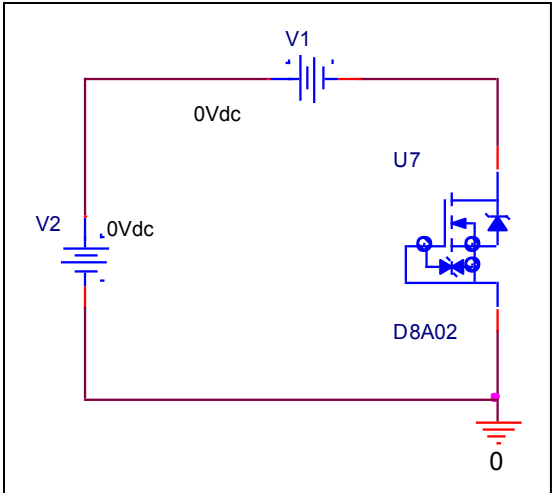


Reverse Characteristic

Circuit Simulation Result

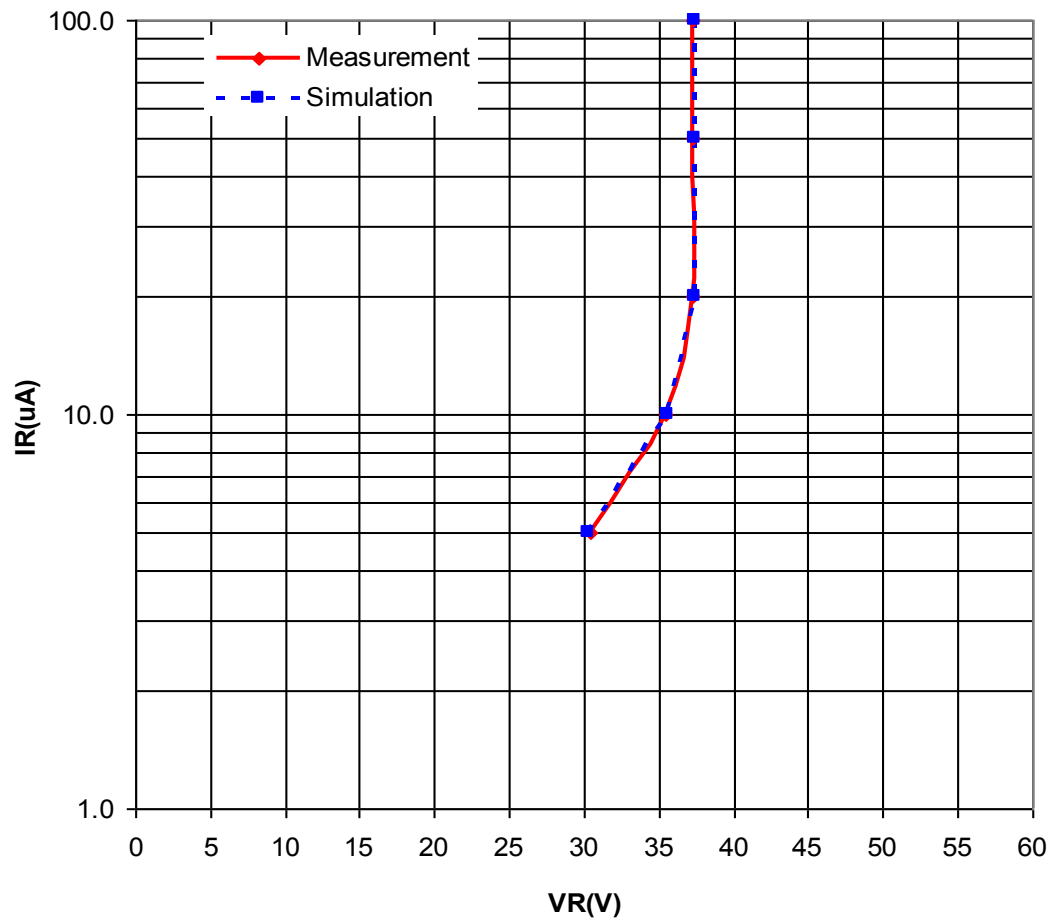


Evaluation circuit



Comparison Graph

Circuit Simulation Result

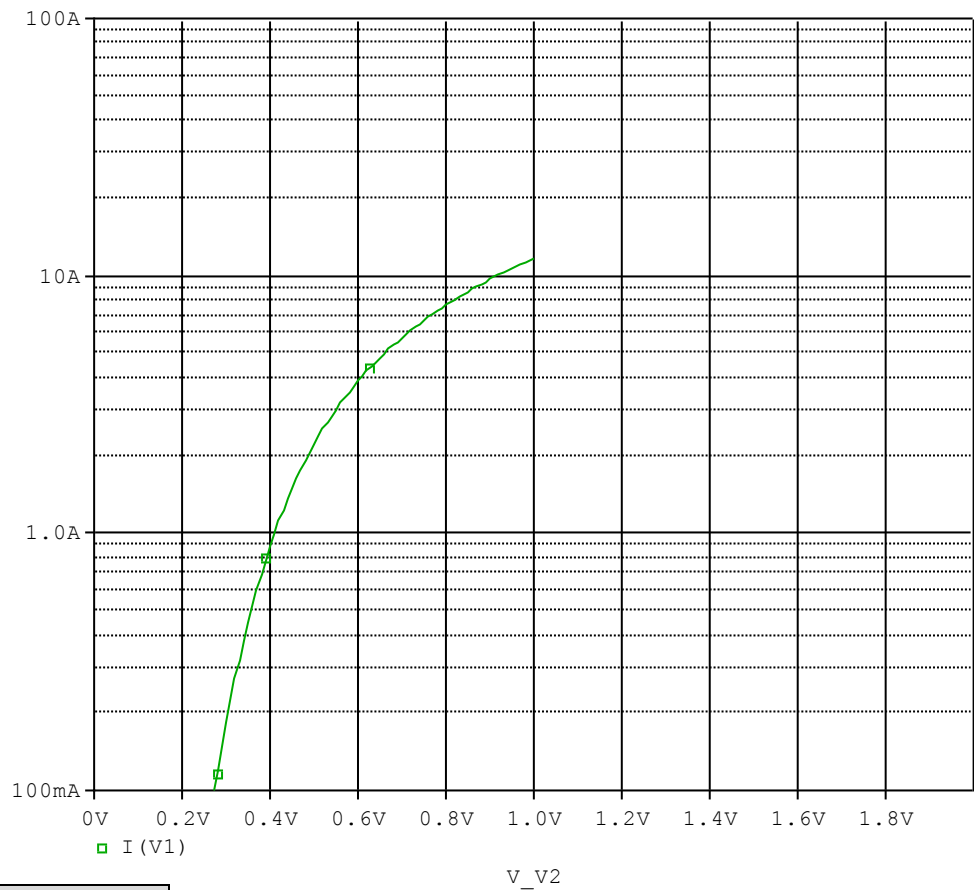


Simulation Result

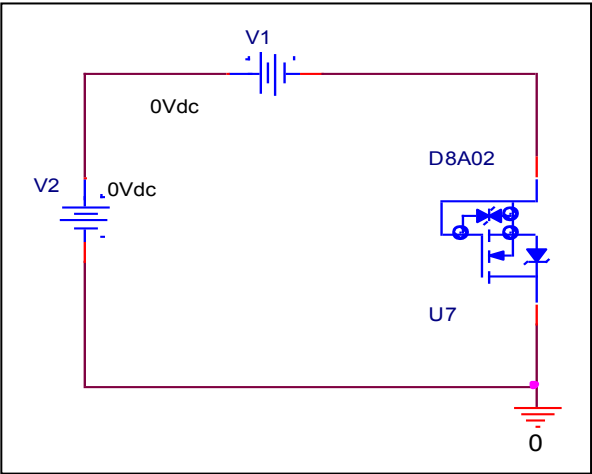
IR(μA)	VR(V)		Error (%)
	Measurement	Simulation	
5.000	30.350	30.347	-0.010
10.000	35.500	35.626	0.355
20.000	37.300	37.376	0.204
50.000	37.300	37.381	0.217
100.000	37.300	37.392	0.247

Forward Current Characteristic

Circuit Simulation Result

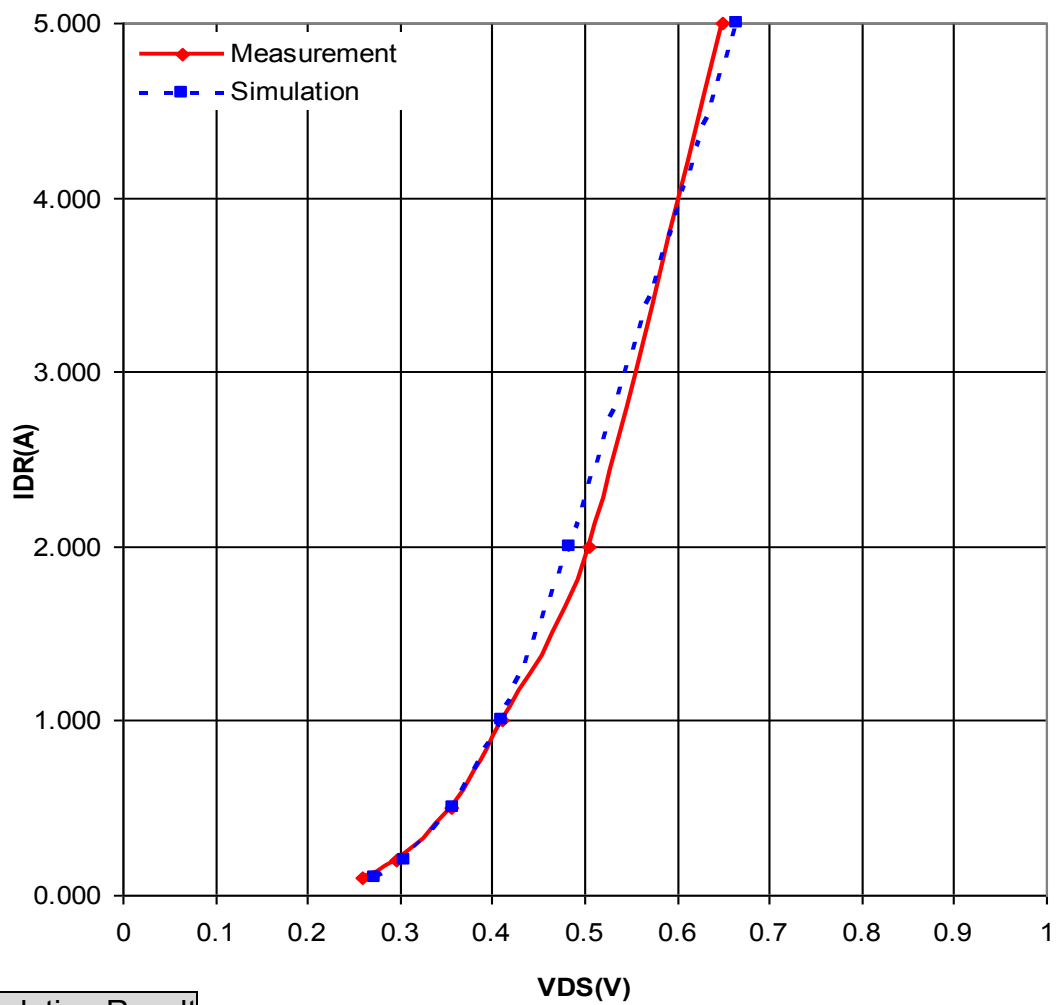


Evaluation Circuit



Comparison Graph

Circuit Simulation Result

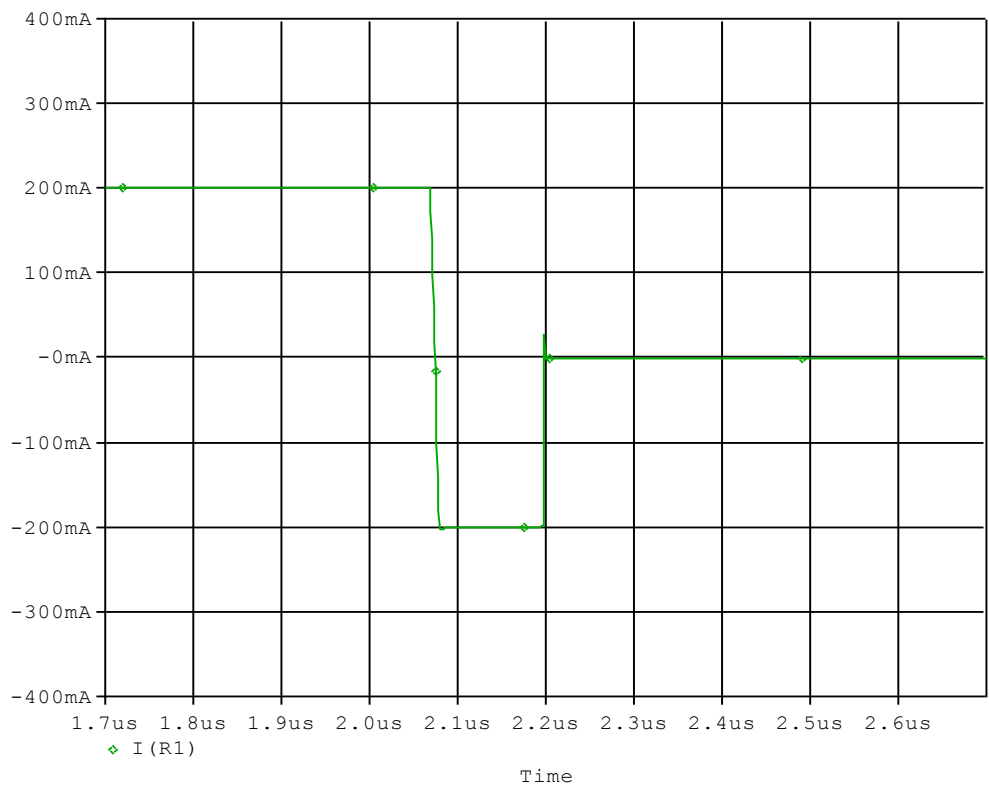


Simulation Result

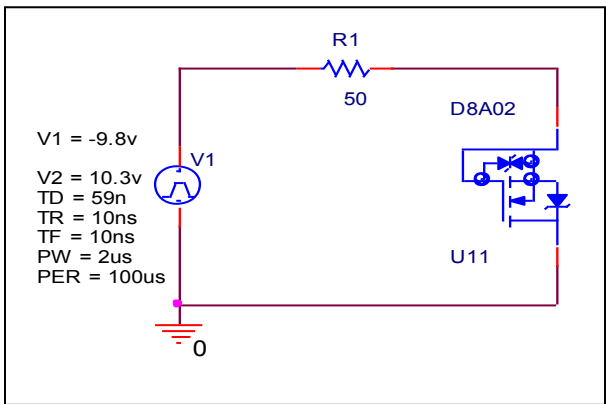
IDR(A)	VSD(V)		%Error
	Measuremen	Simulation	
0.1	0.260	0.272	4.615
0.2	0.295	0.304	3.051
0.5	0.355	0.357	0.563
1	0.410	0.410	0.000
2	0.505	0.485	-3.960
5	0.650	0.665	2.308

Reverse Recovery Characteristic

Circuit Simulation Result



Evaluation Circuit

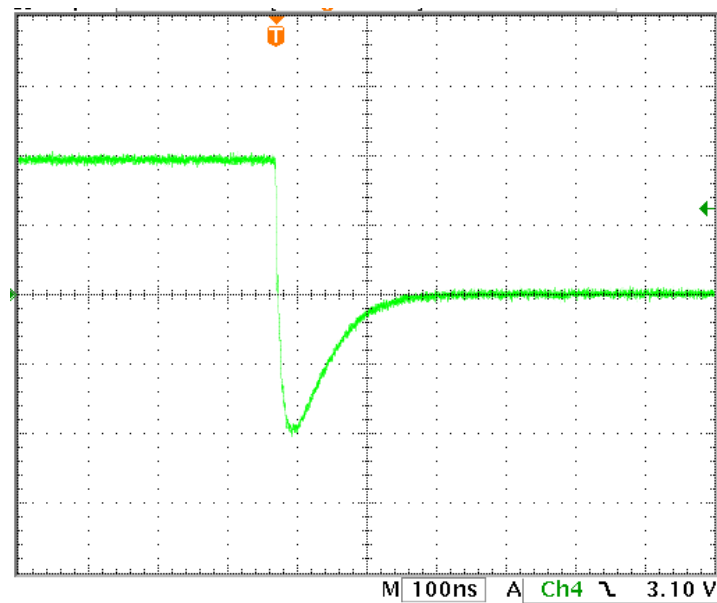


Compare Measurement vs. Simulation

Trr	Measurement	Simulation	Error (%)
Trj+Trb(ns)	124.500	124.548	0.039

Reverse Recovery Characteristic

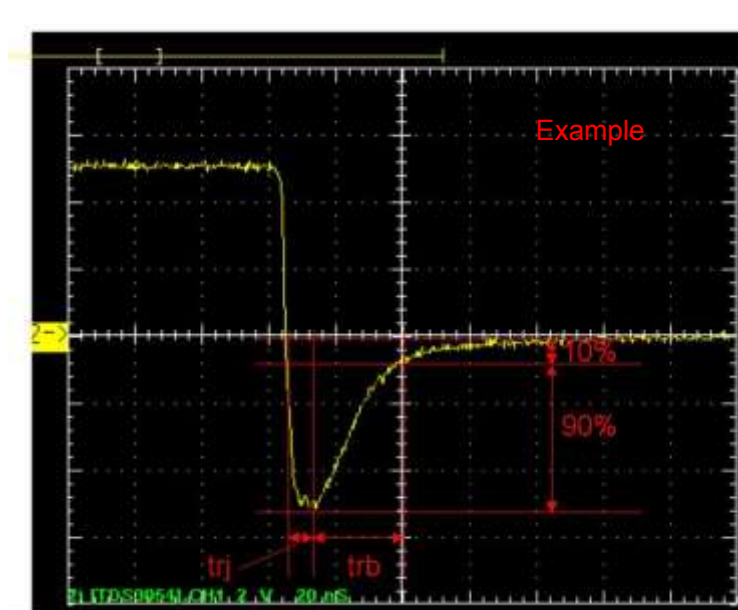
Reference



$T_{rr}=24.5(\text{ns})$

$T_{rb}=100(\text{ns})$

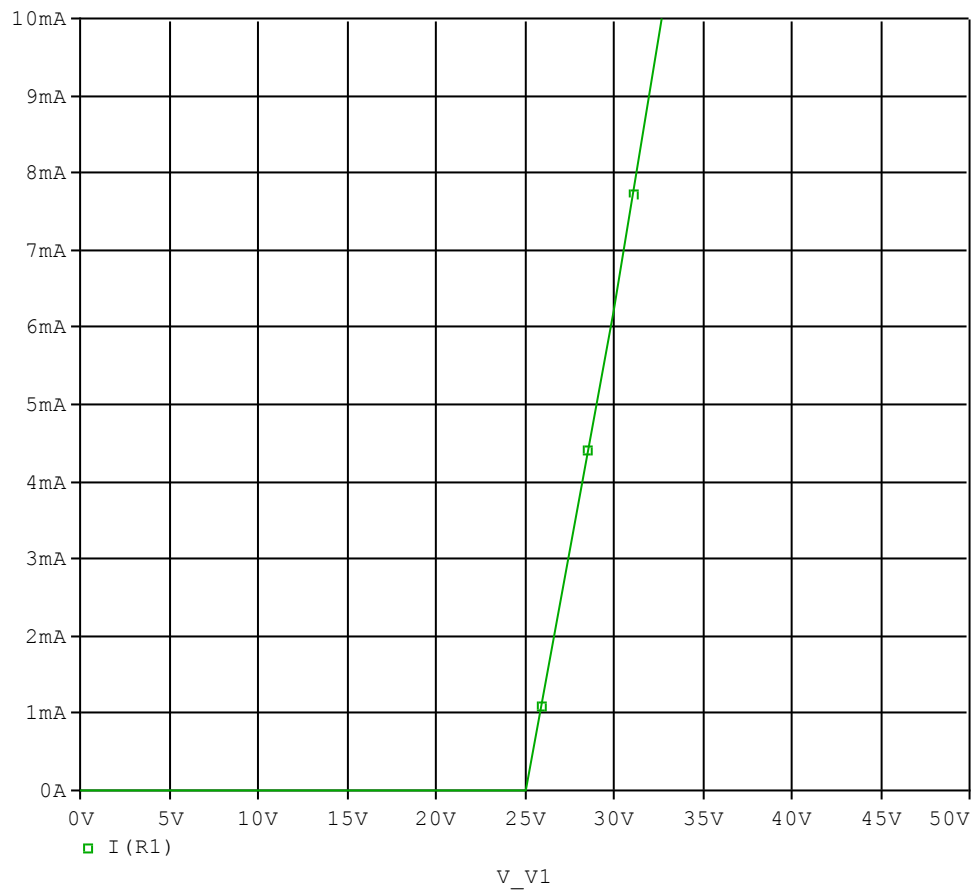
Conditions: $I_{fwd}=I_{rev}=0.2(\text{A})$, $R_L=50$



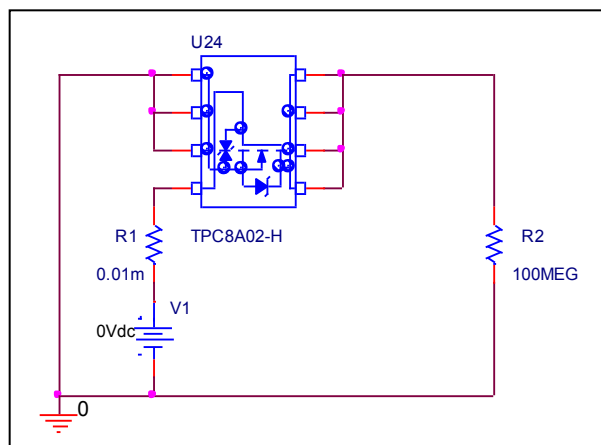
Relation between t_{rr} and t_{rb}

Zener Voltage Characteristic

Circuit Simulation Result



Evaluation Circuit



Zener Voltage Characteristic

Reference

