Device Modeling Report

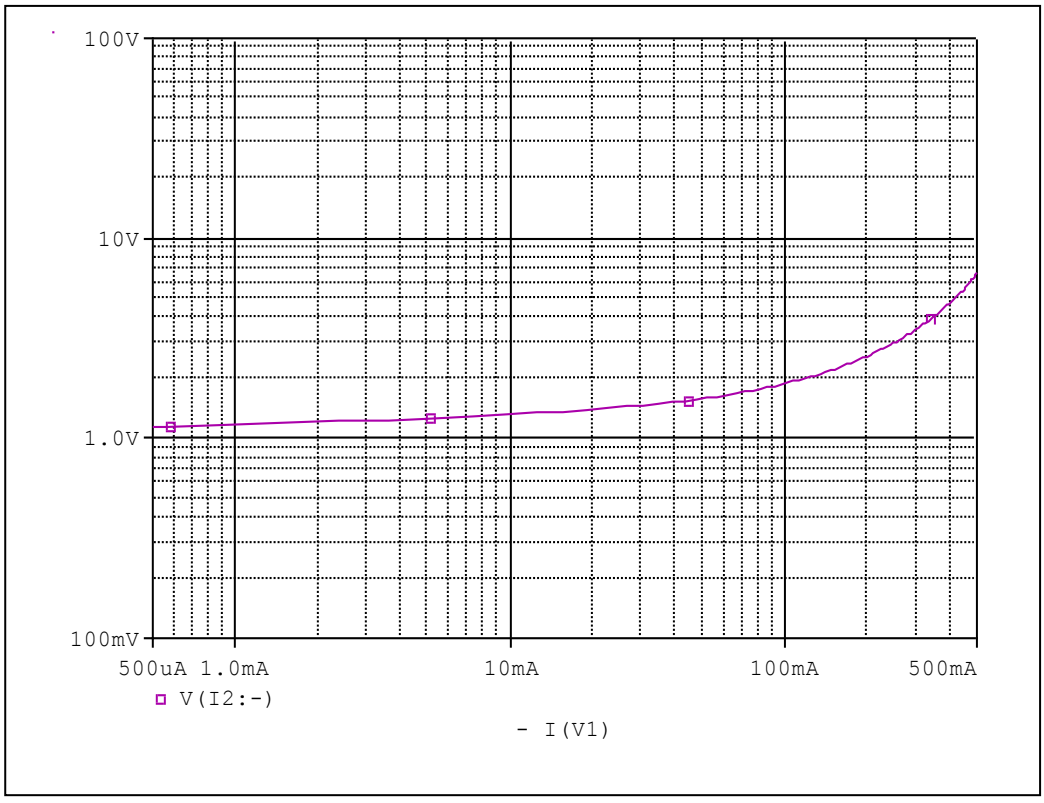
COMPONENTS: Digital transistors (built-in resistors)
PART NUMBER: DTD113ES
MANUFACTURER: ROHM

Bee Technologies Inc.

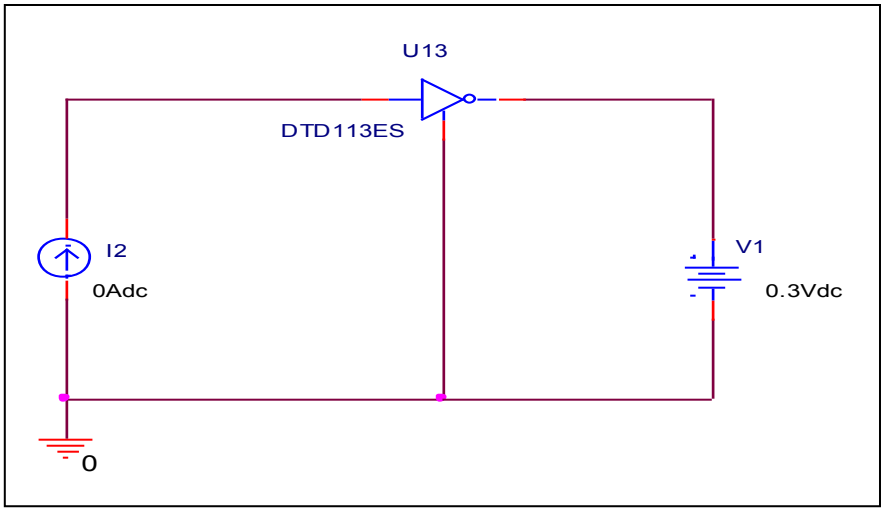
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient
BR	Ideal Maximum Reverse Beta
NR	Reverse Emission Coefficient
VAR	Reverse Early Voltage
IKR	Reverse Beta Roll-off Knee Current
ISC	Non-ideal Base-Collector Diode Saturation Current
NC	Non-ideal Base-Collector Diode Emission Coefficient
NK	Forward Beta Roll-off Slope Exponent
RE	Emitter Resistance
RB	Base Resistance
RC	Series Collector Resistance
CJE	Zero-bias Emitter-Base Junction Capacitance
VJE	Emitter-Base Junction Potential
MJE	Emitter-Base Junction Grading Coefficient
CJC	Zero-bias Collector-Base Junction Capacitance
VJC	Collector-base Junction Potential
MJC	Collector-base Junction Grading Coefficient
FC	Coefficient for Onset of Forward-bias Depletion Capacitance
TF	Forward Transit Time
XTF	Coefficient for TF Dependency on Vce
VTF	Voltage for TF Dependency on Vce
ITF	Current for TF Dependency on Ic
PTF	Excess Phase at f=1/2pi*TF
TR	Reverse Transit Time
EG	Activation Energy
XTB	Forward Beta Temperature Coefficient
XTI	Temperature Coefficient for IS

Input voltage vs. output current (ON characteristics)

Circuit simulation result

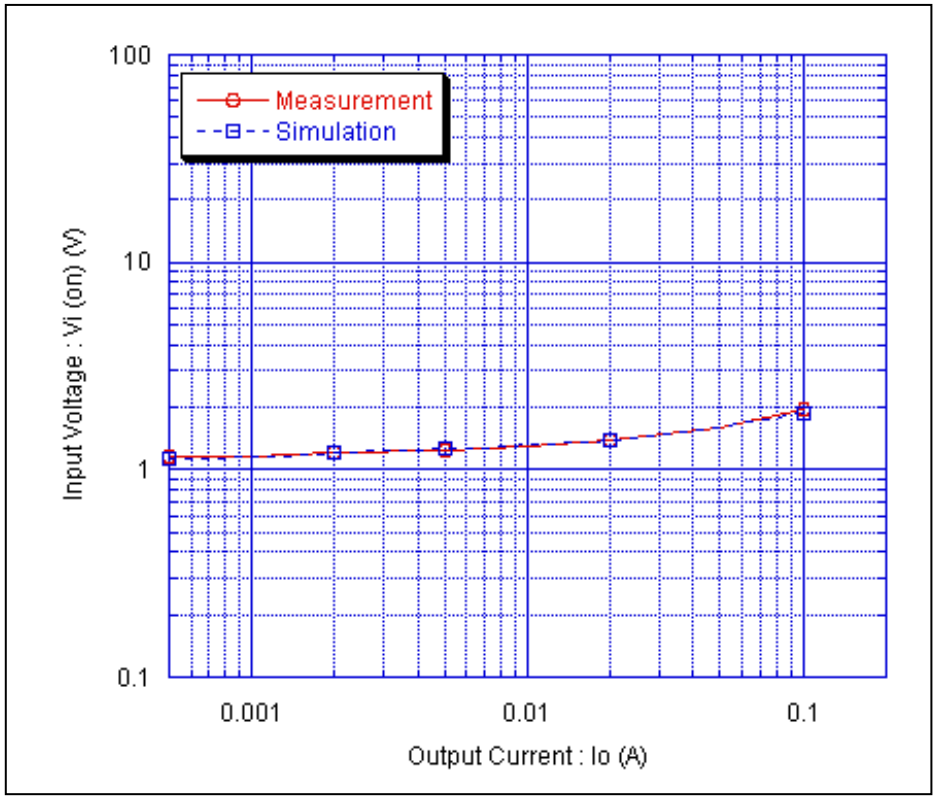


Evaluation circuit



Comparison Graph

Circuit Simulation Result



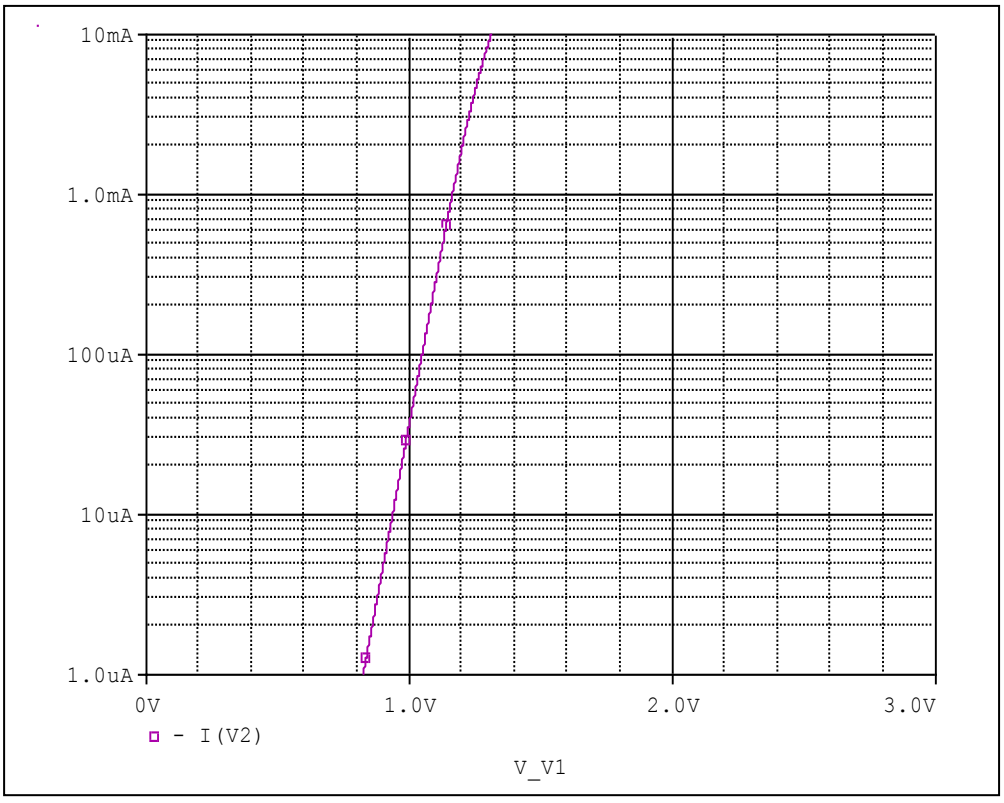
Simulation Result

Condition @ Vo = 0.3 V

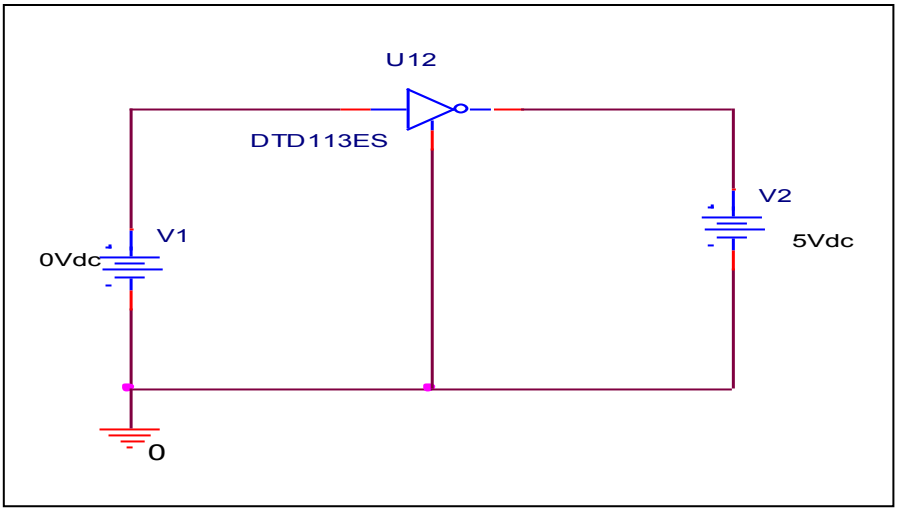
Ic(A)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
500u	1.150	1.128	-1.913
1m	1.170	1.164	-0.513
2m	1.200	1.203	0.250
5m	1.250	1.259	0.720
10m	1.300	1.315	1.154
20m	1.400	1.392	-0.571
50m	1.600	1.577	-1.438
100m	1.950	1.876	-3.795

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

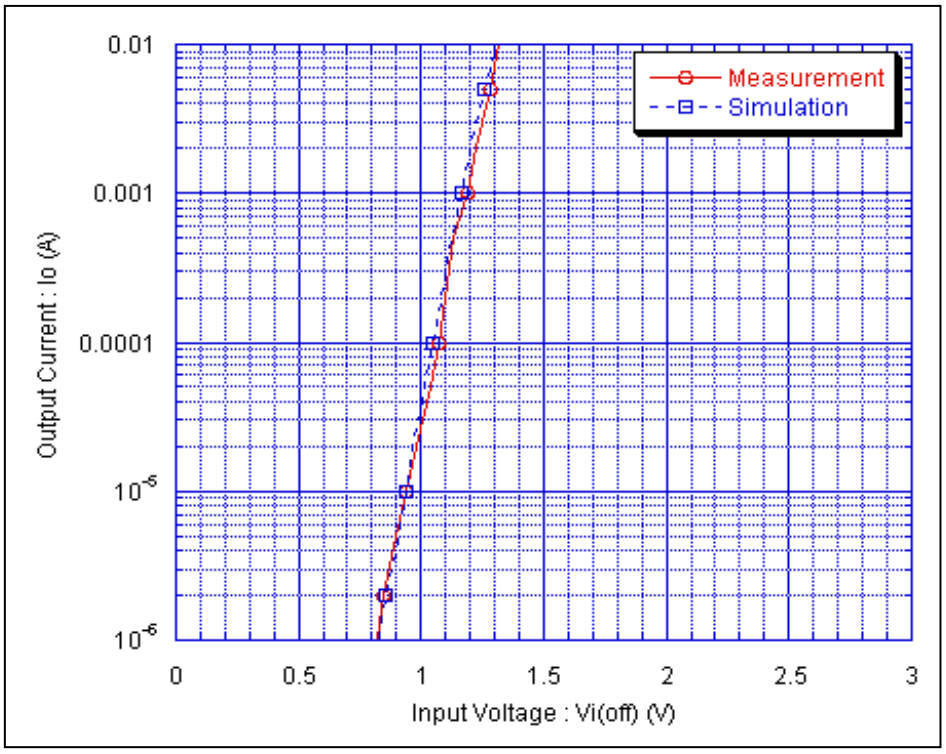


Evaluation circuit



Comparison Graph

Circuit Simulation Result



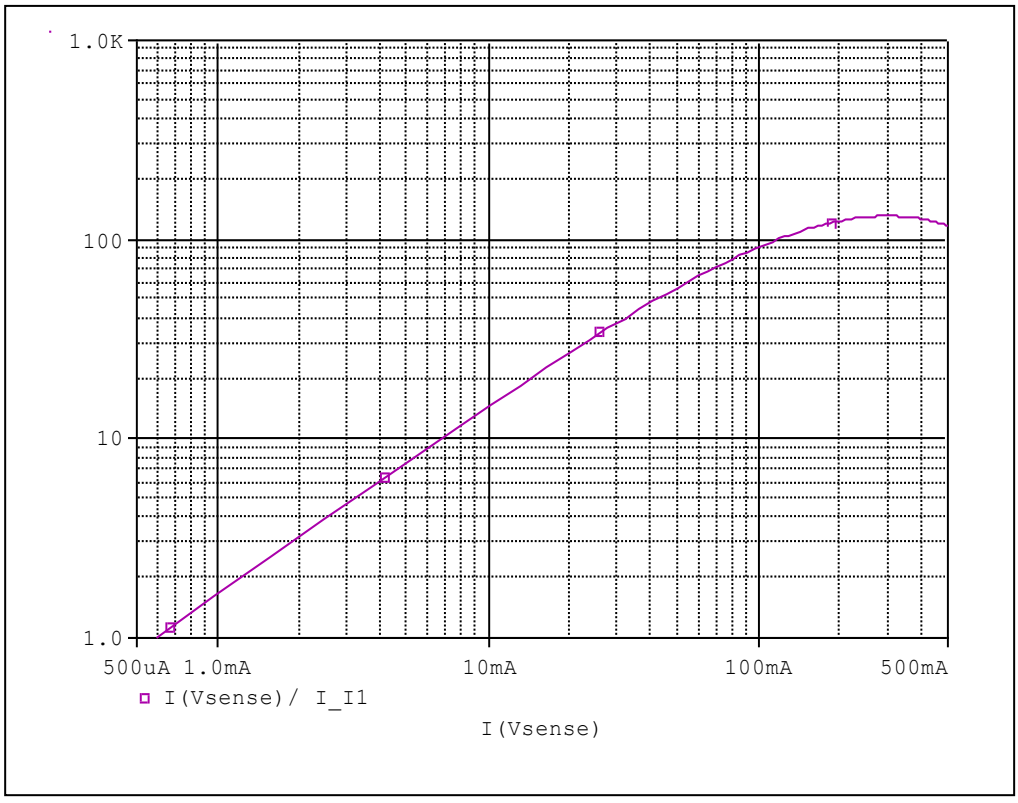
Simulation Result

Condition @ Vcc = 5 V

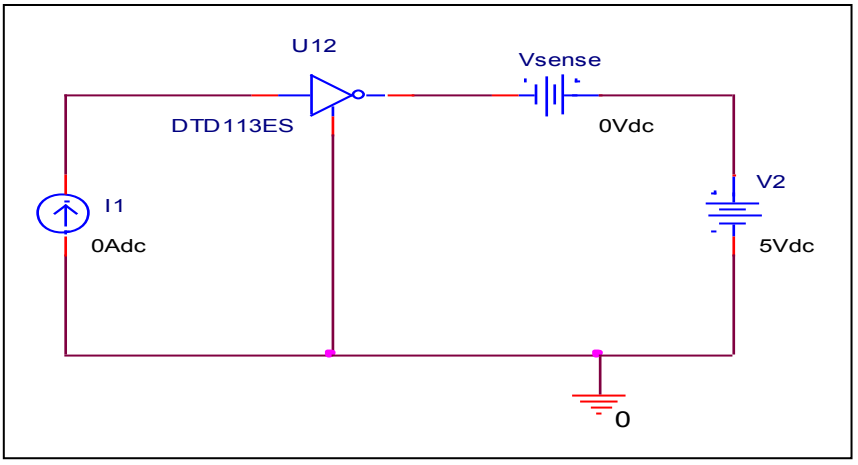
Ic(A)	$V_{I(OFF)}$ (V)		Error (%)
	Datasheet	Simulation	
1u	0.810	0.823	1.605
2u	0.850	0.856	0.706
5u	0.900	0.902	0.222
10u	0.940	0.935	-0.532
20u	0.980	0.968	-1.224
50u	1.040	1.013	-2.596
100u	1.070	1.046	-2.243
200u	1.100	1.081	-1.727
500u	1.130	1.127	-0.265
1m	1.190	1.162	-2.353
2m	1.220	1.200	-1.639
5m	1.280	1.256	-1.875
10m	1.320	1.310	-0.758

DC current gain vs. output current

Circuit simulation result

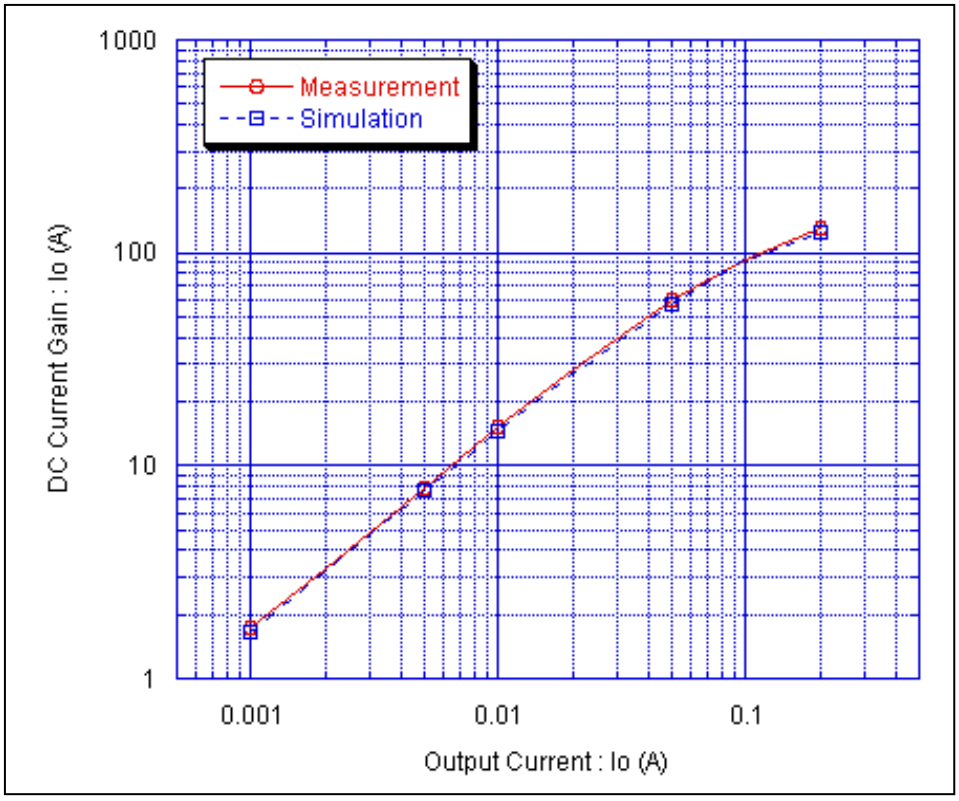


Evaluation circuit



Comparison Graph

Circuit Simulation Result



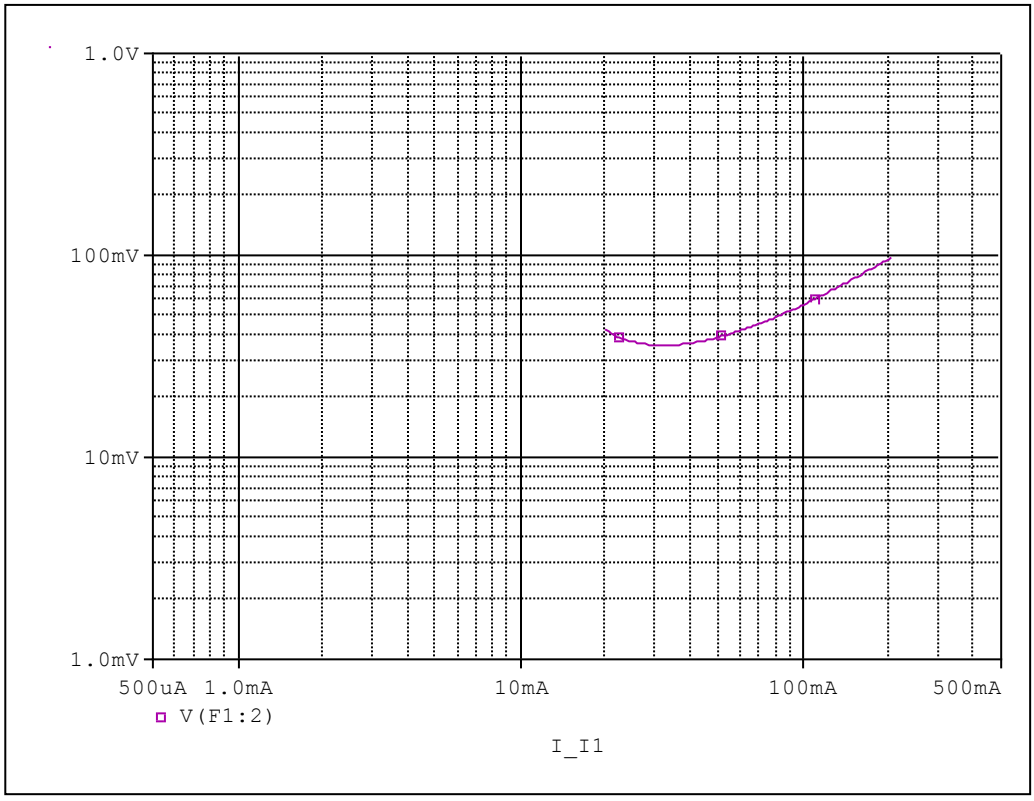
Simulation Result

Condition @ Vo = 5 V

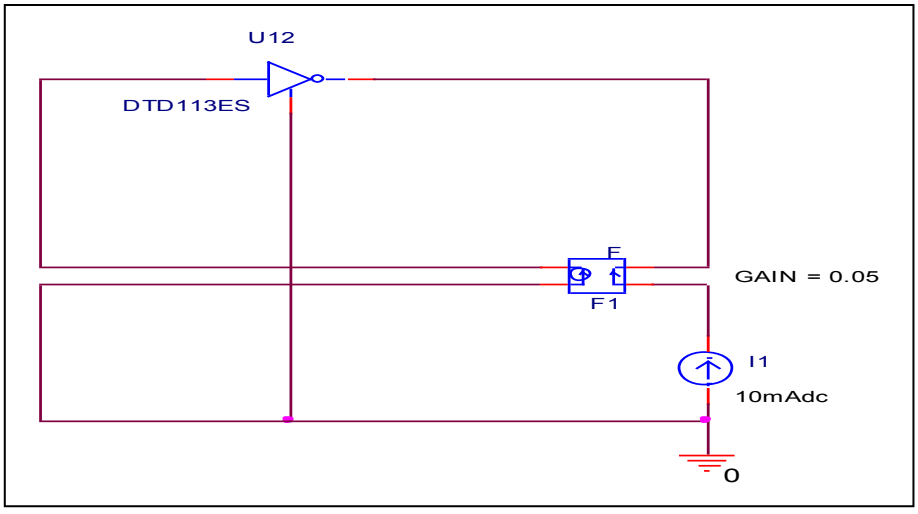
Ic(A)	hFE		Error (%)
	Datasheet	Simulation	
1m	1.750	1.667	-4.743
2m	3.300	3.213	-2.636
5m	7.850	7.591	-3.299
10m	15.100	14.517	-3.861
20m	28.000	26.987	-3.618
50m	60.000	57.488	-4.187
100m	92.500	91.723	-0.840
200m	130.000	124.081	-4.553

Output voltage VS. output current

Circuit simulation result

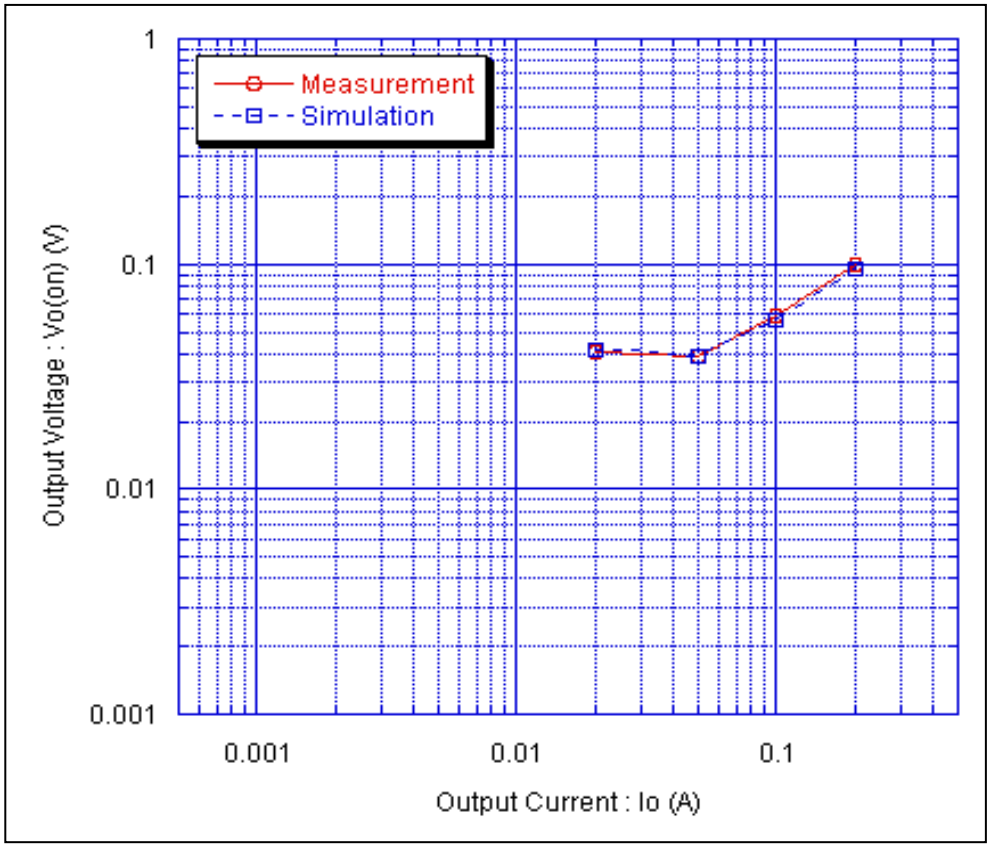


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ I_o/I_I = 20

Ic(A)	V_{CE} (sat)		Error (%)
	Datasheet	Simulation	
20m	0.041	0.042	2.439
50m	0.039	0.039	1.299
100m	0.059	0.057	-3.390
200m	0.100	0.096	-4.000