

Device Modeling Report

COMPONENTS: Digital transistors (built-in resistors)
PART NUMBER: DTC144ESA
MANUFACTURER: ROHM

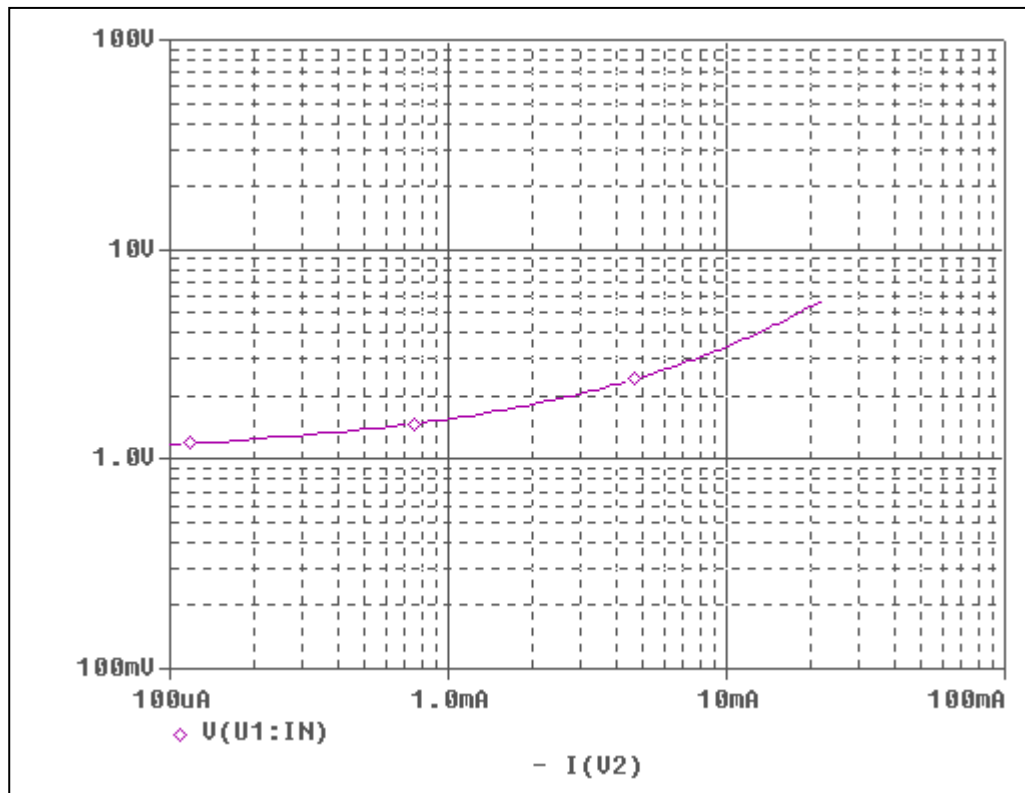


Bee Technologies Inc.

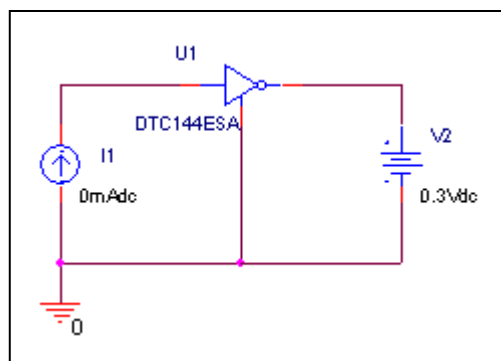
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient
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 $f=1/2\pi \cdot TF$
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

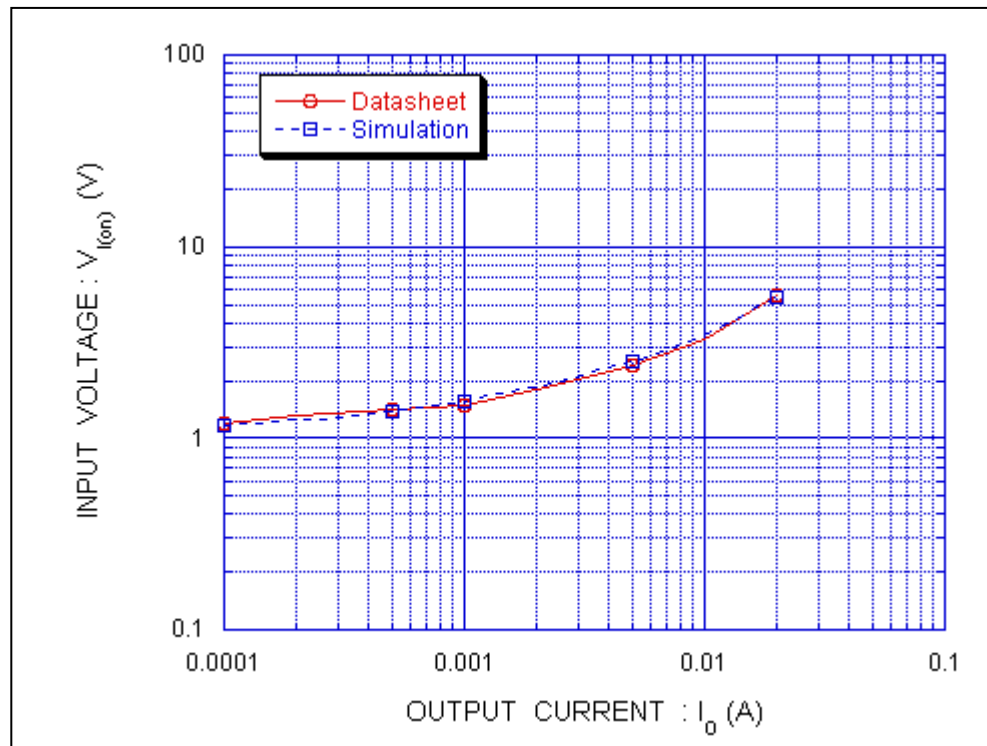


Evaluation circuit



Comparison Graph

Circuit Simulation Result



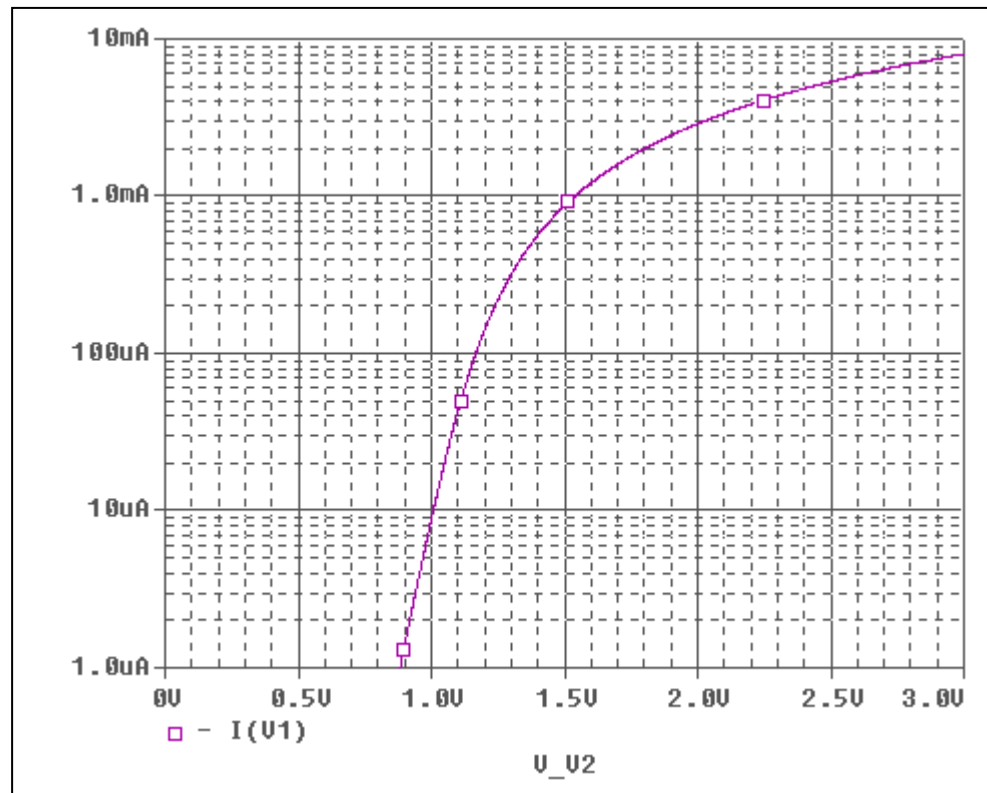
Simulation Result

Condition @ $V_o = 0.3$ V

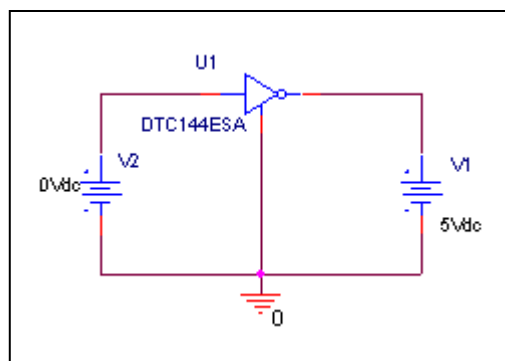
I_c (A)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
100u	1.2	1.1728	-2.31924
200u	1.3	1.2466	-4.28365
500u	1.4	1.3884	-0.83549
1m	1.5	1.5572	3.67326
2m	1.8	1.8289	1.58018
5m	2.4	2.4902	3.62220
10m	3.3	3.4579	4.56636
20m	5.6	5.3823	-4.04474

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

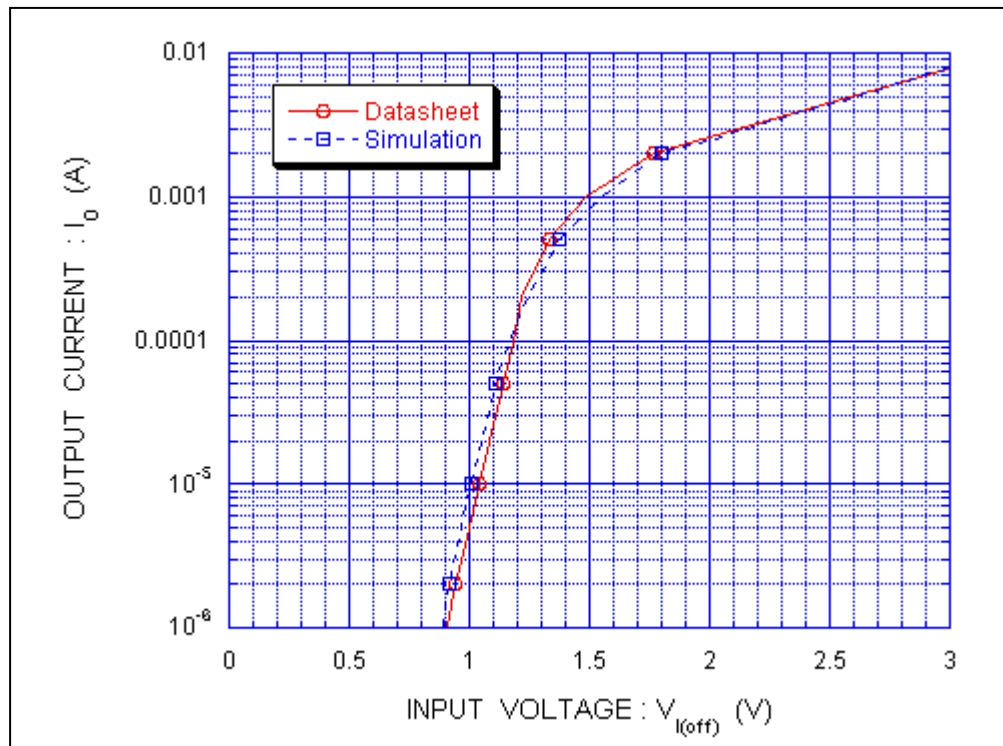


Evaluation circuit



Comparison Graph

Circuit Simulation Result



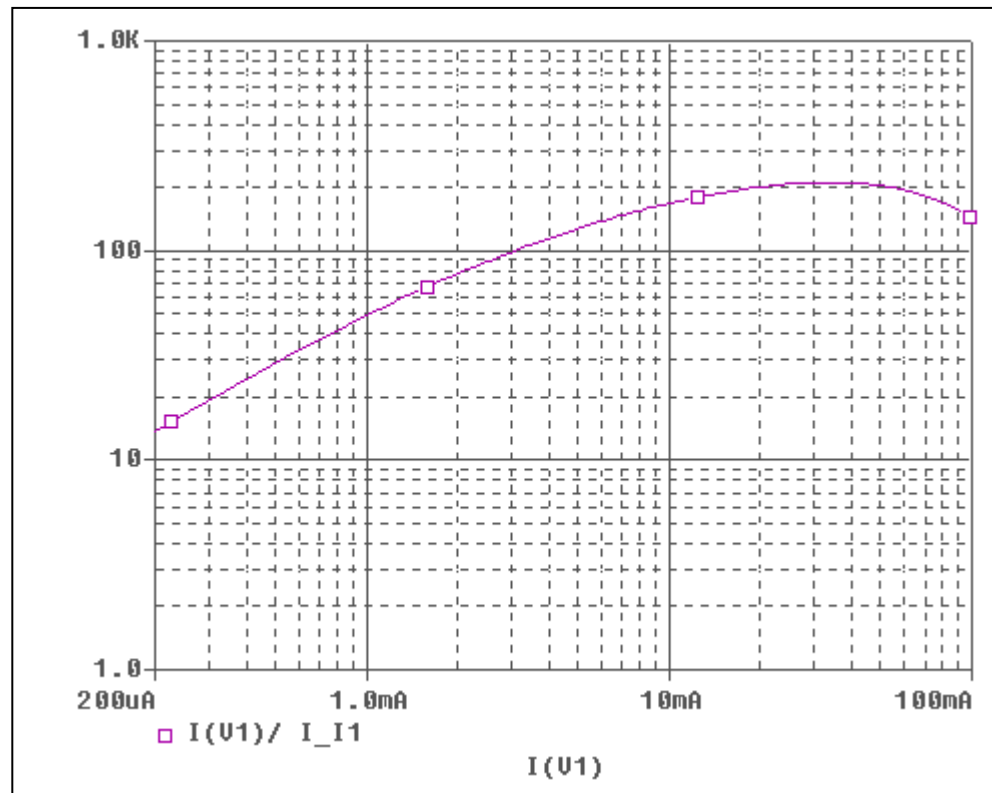
Simulation Result

Condition @ $V_{cc} = 5\text{ V}$

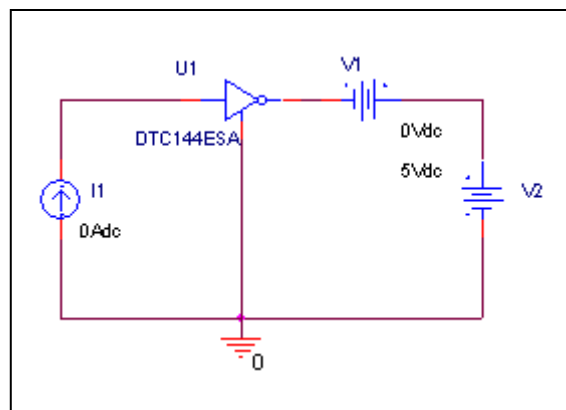
$I_c(\text{A})$	$V_{I(OFF)} (\text{V})$		Error (%)
	Datasheet	Simulation	
1u	0.9	0.882328	-2.00288
2u	0.94	0.921153	-2.04602
5u	1.0	0.968579	-3.24403
10u	1.04	1.0085	-3.12345
20u	1.08	1.0510	-2.75928
50u	1.14	1.1126	-2.46270
100u	1.18	1.1682	-1.01010
200u	1.22	1.2379	1.44600
500u	1.33	1.3793	3.57428
1m	1.48	1.5414	3.98339
2m	1.77	1.800	1.66667
8m	3	2.9966	-0.11346

DC current gain vs. output current

Circuit simulation result

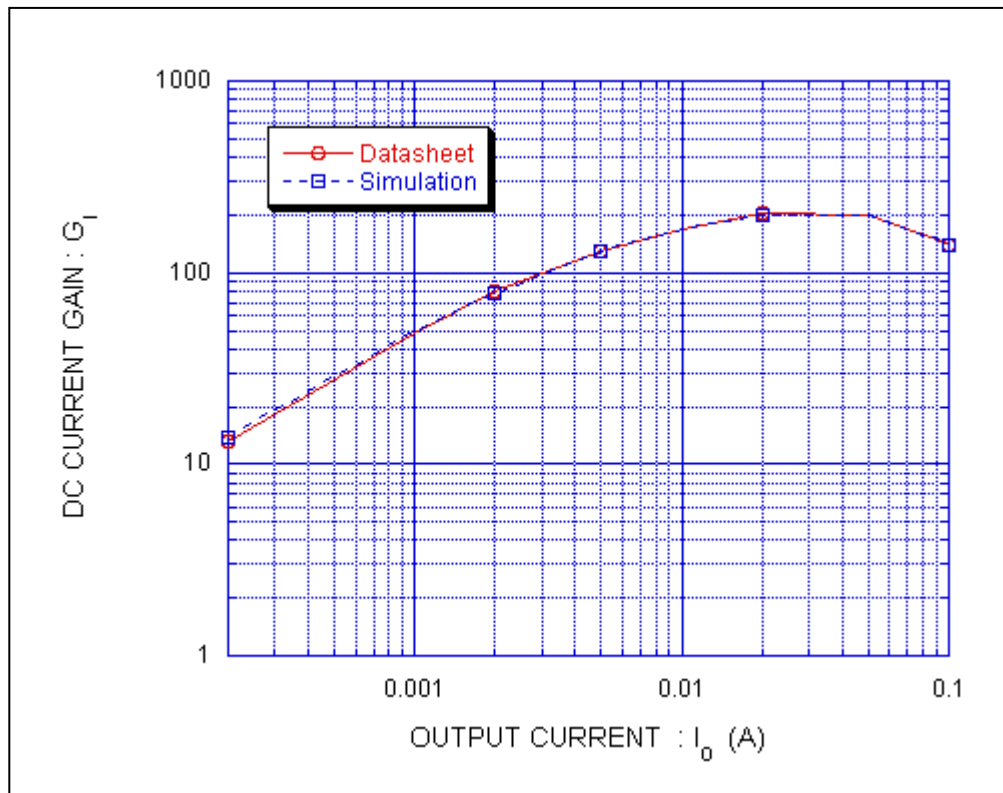


Evaluation circuit



Comparison Graph

Circuit Simulation Result



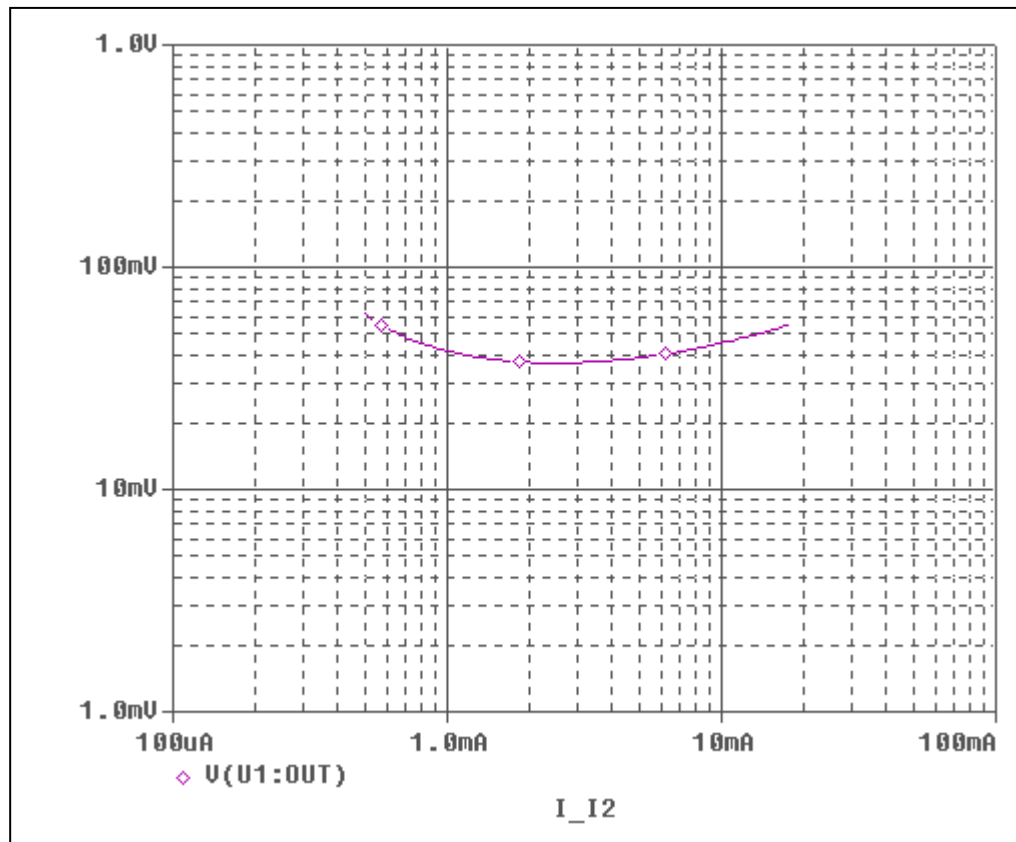
Simulation Result

Condition @ $V_o = 5\text{ V}$

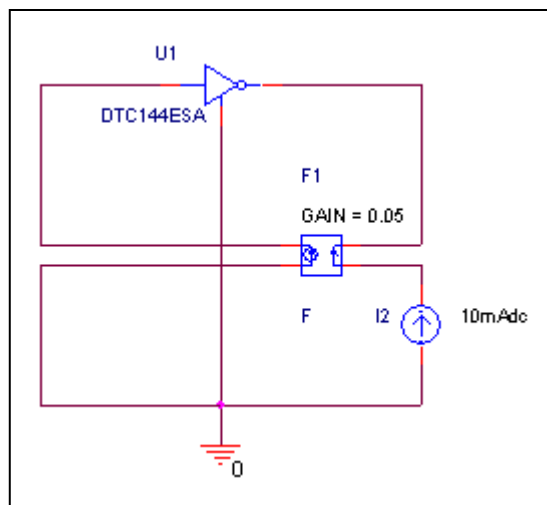
$I_c(\text{A})$	hFE		Error (%)
	Datasheet	Simulation	
200u	13	13.728	5.30303
1m	48	49.178	2.39538
2m	80	77.853	-2.75776
5m	130	127.886	-1.65303
10m	170	168.300	-1.01010
20m	205	201.164	-1.90690
50m	200	204.125	2.01842
100m	140	137.726	-1.65110

Output voltage VS. output current

Circuit simulation result

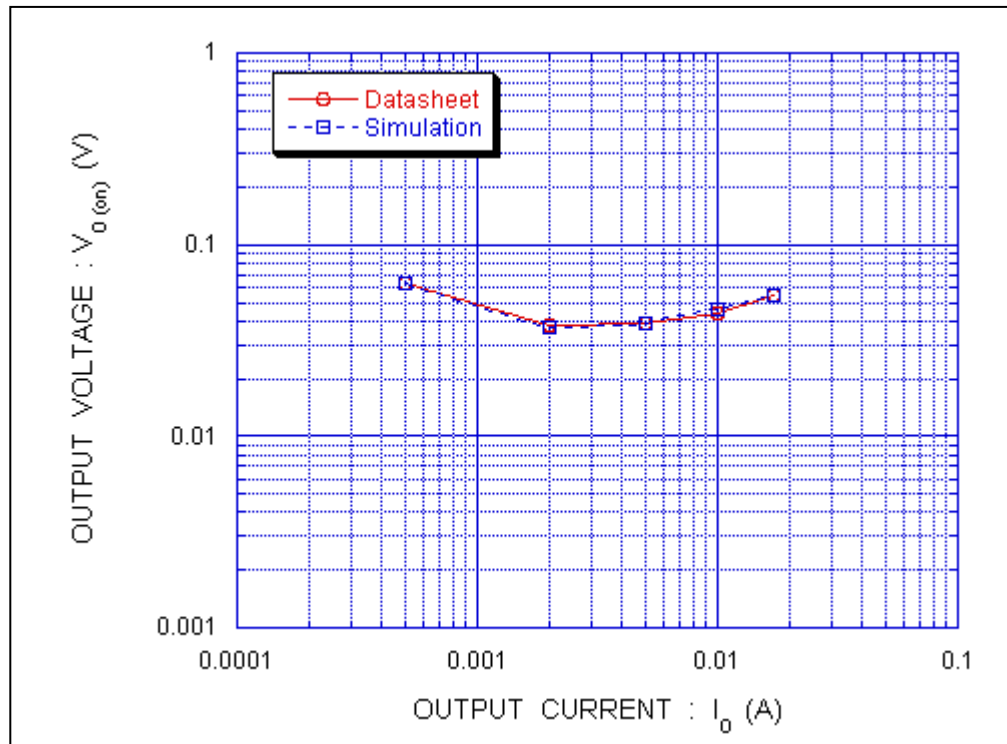


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ $I_o/I_l = 20$

$I_c(A)$	$V_{CE} (sat)$		Error (%)
	Datasheet	Simulation	
500u	63m	62.235m	-1.22921
2m	38m	37.351m	-1.73757
5m	39m	39.199m	0.50767
10m	44m	45.669m	3.65456
17m	54m	54.412m	0.75719