

Device Modeling Report

COMPONENTS: Digital transistors (built-in resistors)
PART NUMBER: DTC123EM
MANUFACTURER: ROHM

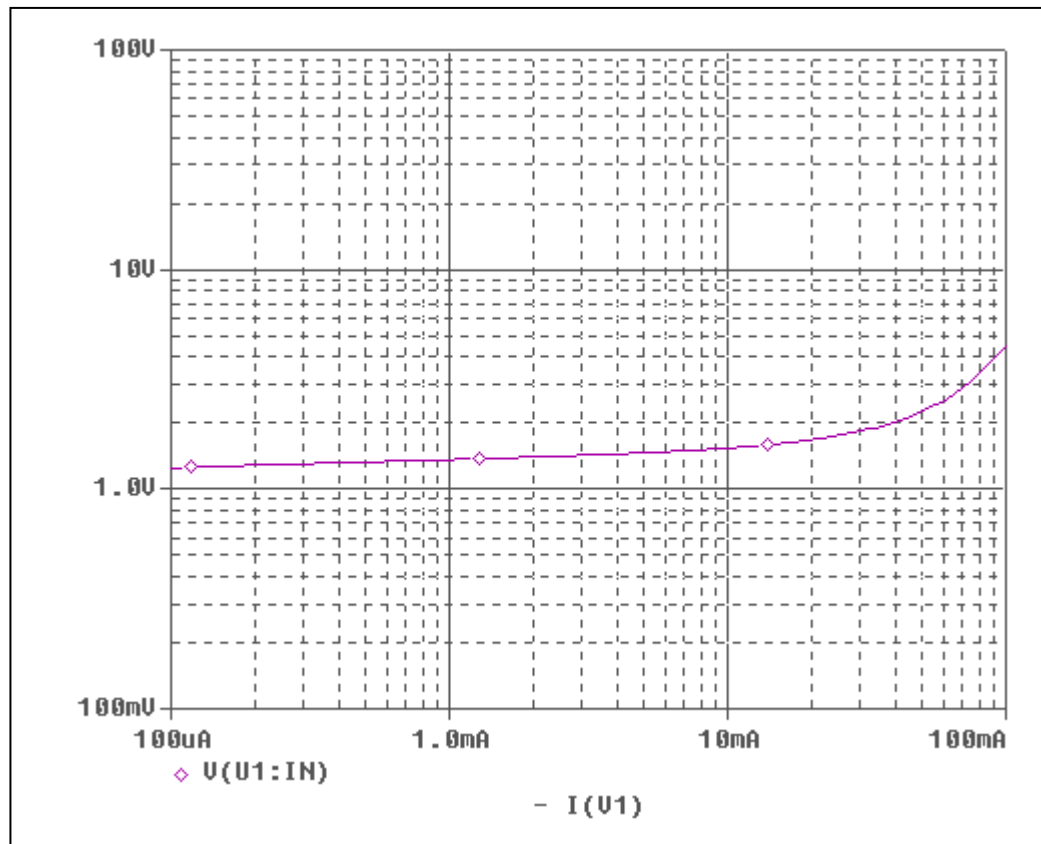


Bee Technologies Inc.

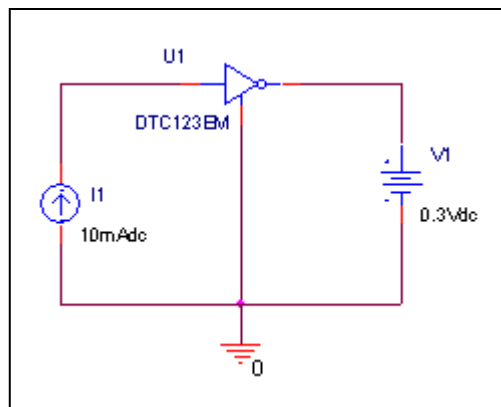
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient
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

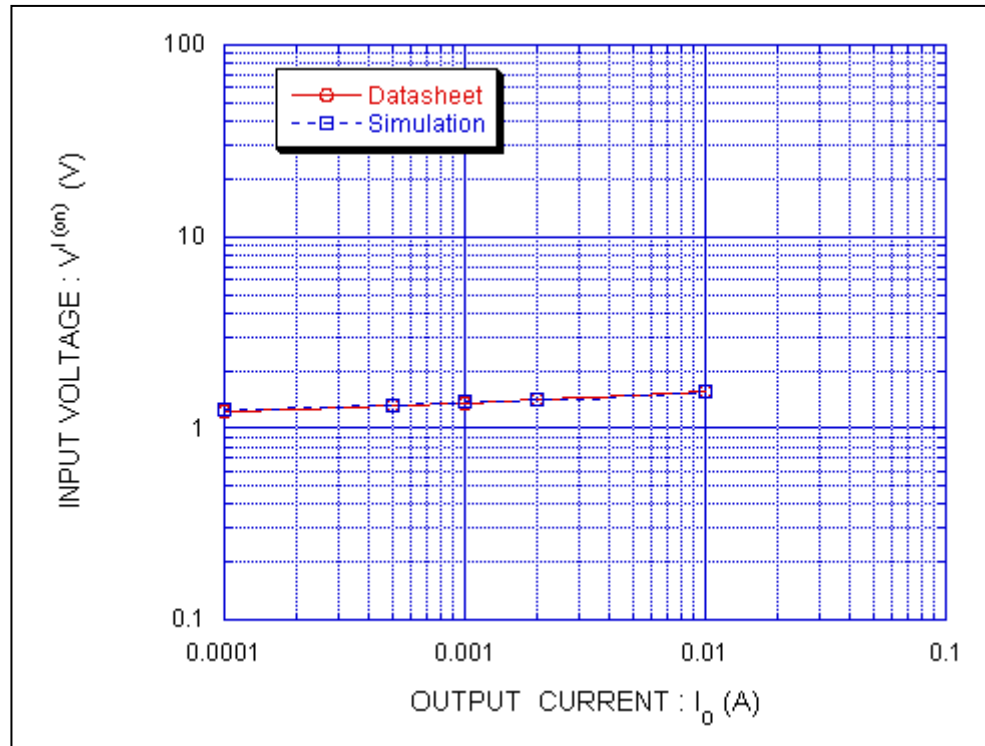


Evaluation circuit



Comparison Graph

Circuit Simulation Result



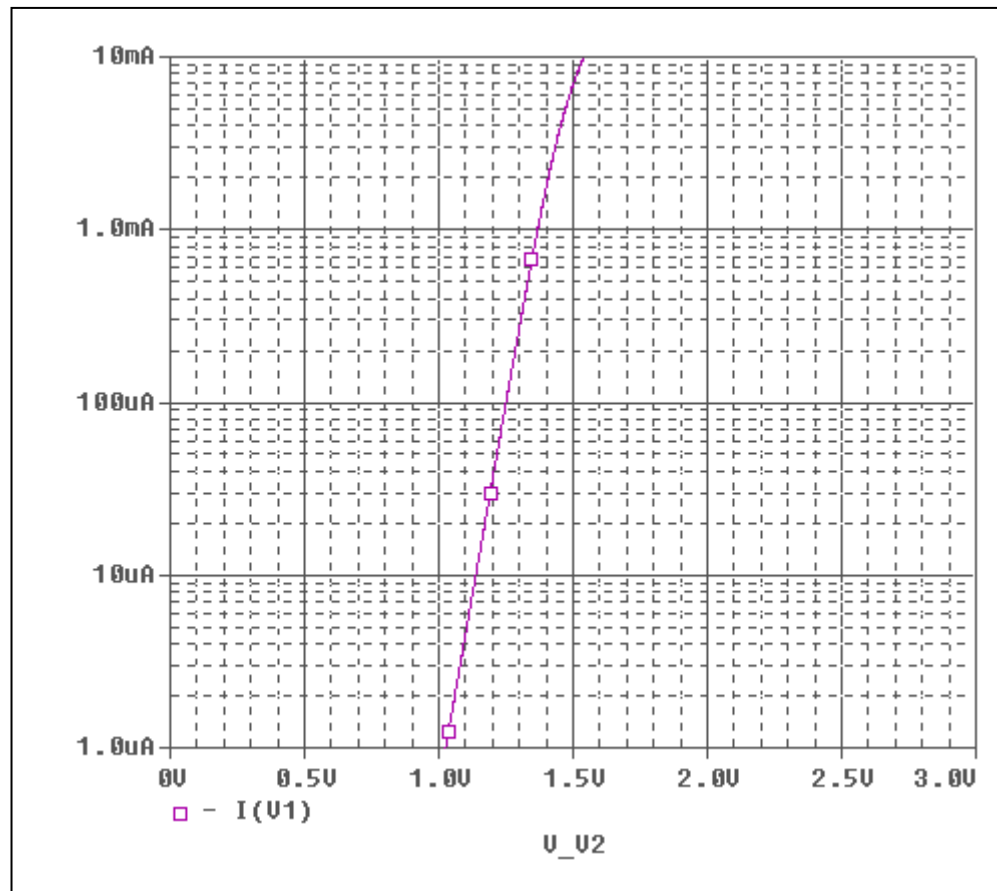
Simulation Result

Condition @ $V_o = 0.3$ V

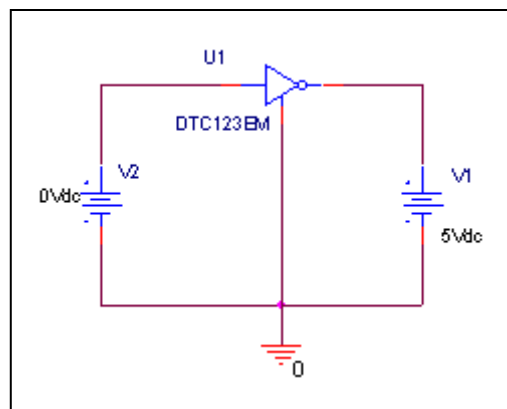
I_c (A)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
100u	1.25	1.2507	0.05597
200u	1.3	1.2873	-0.98656
500u	1.35	1.3335	-1.23735
1m	1.4	1.3707	-2.13759
2m	1.45	1.4112	-2.74943
5m	1.5	1.4762	-1.61225
10m	1.6	1.5483	-3.33915
20m	1.7	1.6823	-1.05213
100m	4.6	4.4435	-3.52200

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

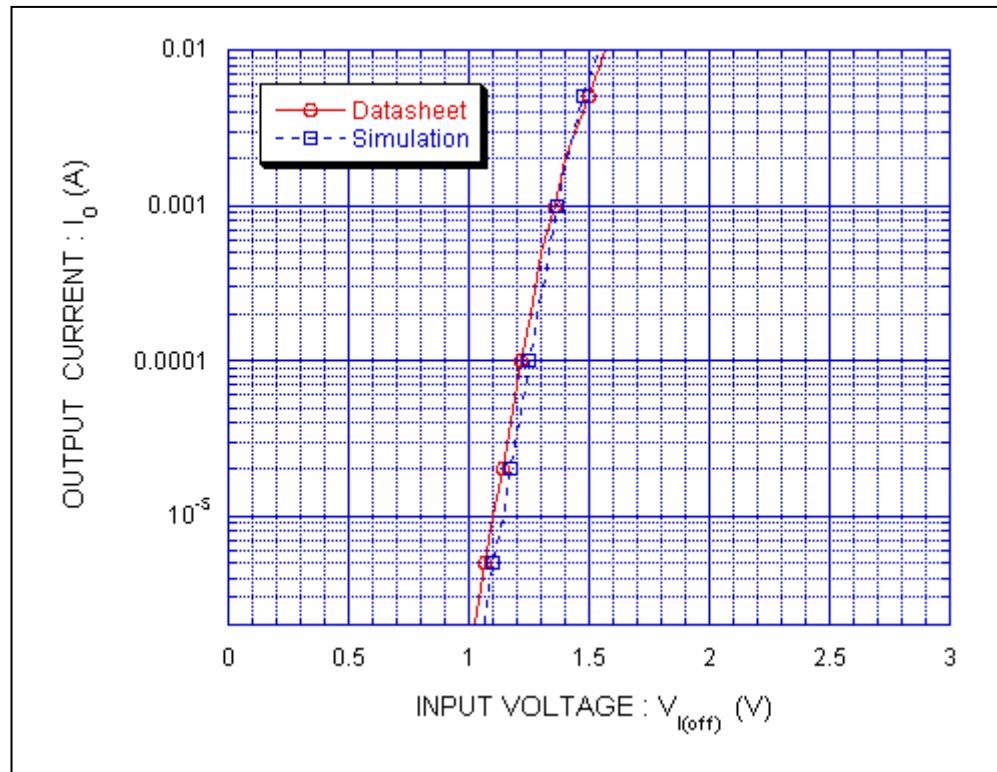


Evaluation circuit



Comparison Graph

Circuit Simulation Result



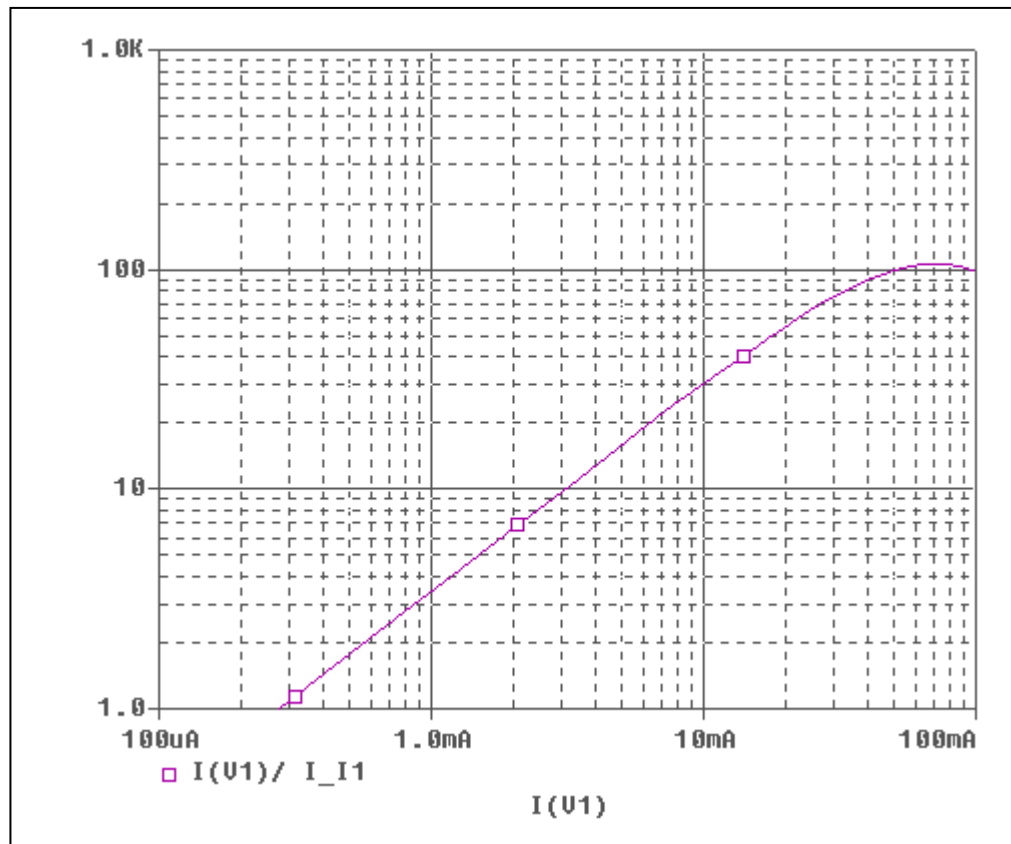
Simulation Result

Condition @ $V_{cc} = 5$ V

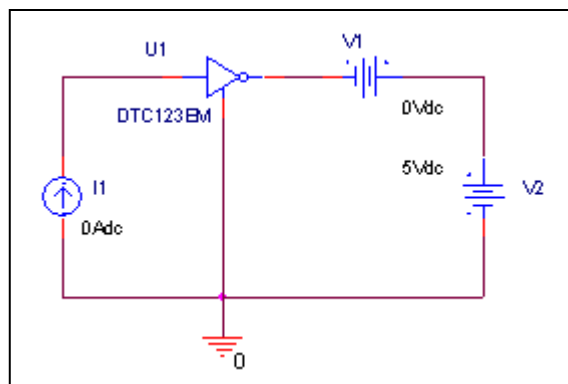
I_c (A)	$V_{l(OFF)}$ (V)		Error (%)
	Datasheet	Simulation	
2u	1.02	1.0599	3.76451
5u	1.07	1.1044	3.11481
10u	1.1	1.1379	3.33070
20u	1.14	1.1718	2.71377
50u	1.18	1.2164	2.99244
100u	1.22	1.2510	2.47802
200u	1.26	1.2860	2.02177
500u	1.3	1.3309	2.32174
1m	1.36	1.3682	0.59933
2m	1.4	1.4087	0.61759
5m	1.5	1.4724	-1.87449
10m	1.57	1.5414	-1.85546

DC current gain vs. output current

Circuit simulation result

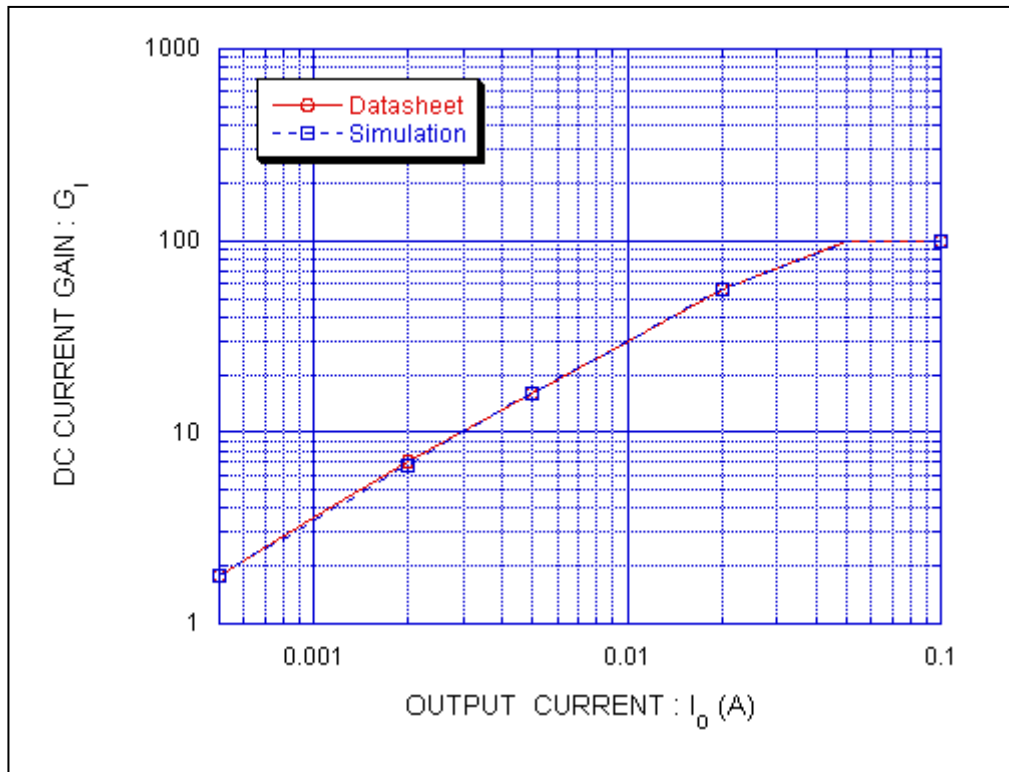


Evaluation circuit



Comparison Graph

Circuit Simulation Result



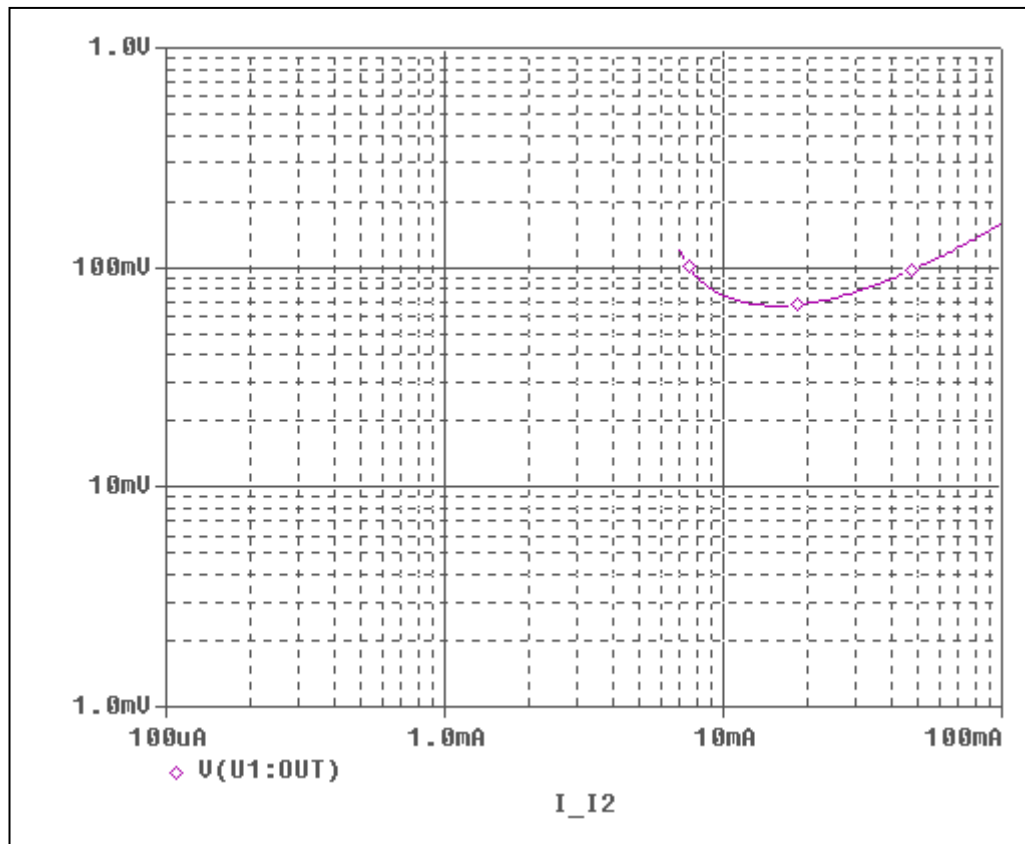
Simulation Result

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

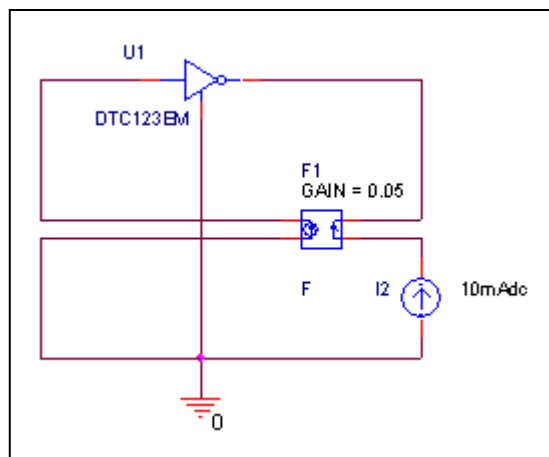
$I_c(\text{A})$	hFE		Error (%)
	Datasheet	Simulation	
500u	1.8	1.7629	-2.10449
1m	3.6	3.4317	-4.90427
2m	7	6.6679	-4.98058
5m	16	15.993	-0.04377
10m	30	30.160	0.53050
20m	56	55.080	-1.67030
50m	99	99.270	0.27199
100m	100	98.643	-1.37567

Output voltage VS. output current

Circuit simulation result

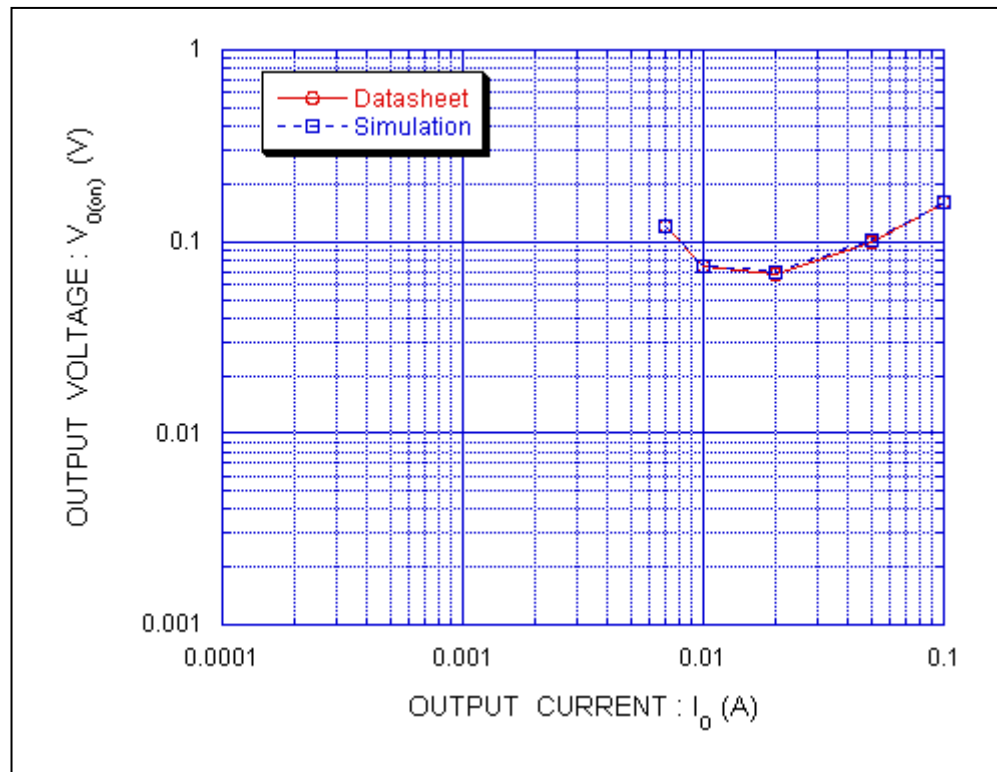


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ $I_O/I_I = 20$

$I_c(A)$	$V_{CE} (sat)$		Error (%)
	Datasheet	Simulation	
7m	120m	119.345m	-0.54883
10m	74m	74.756m	1.01129
20m	68m	68.805m	1.16997
50m	100m	100.684m	0.67935
100m	160m	159.431m	-0.35689