Device Modeling Report

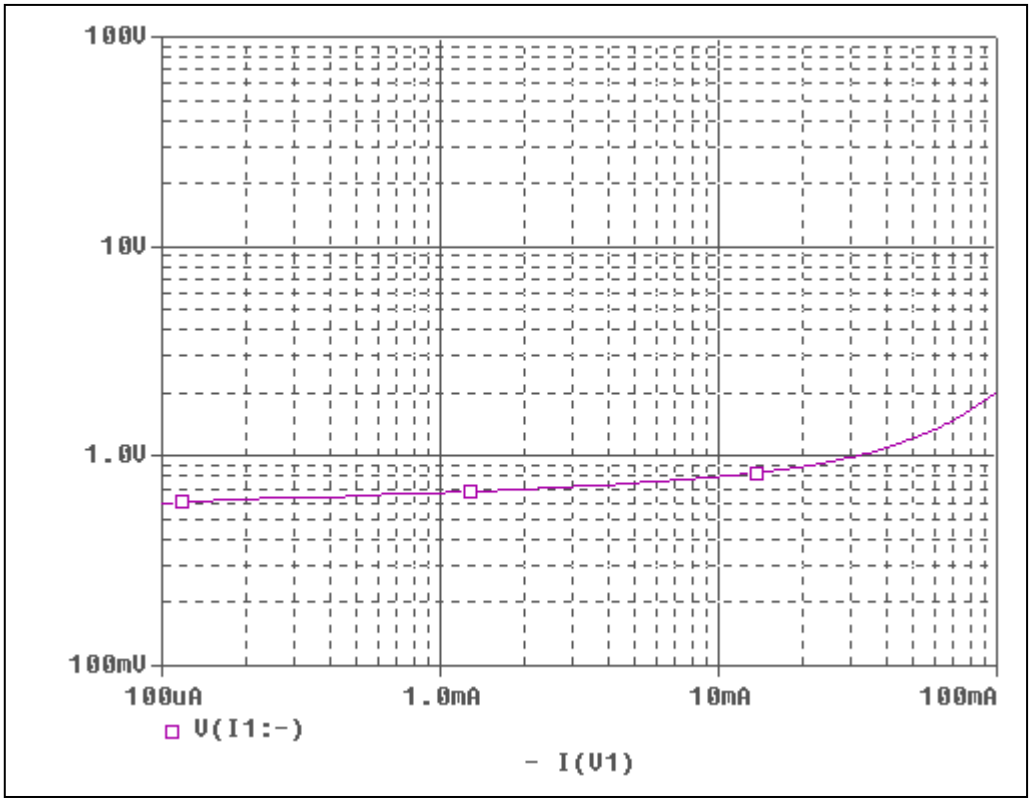
COMPONENTS: Digital transistors (built-in resistors)
PART NUMBER: DTC113ZKA
MANUFACTURER: ROHM

Bee Technologies Inc.

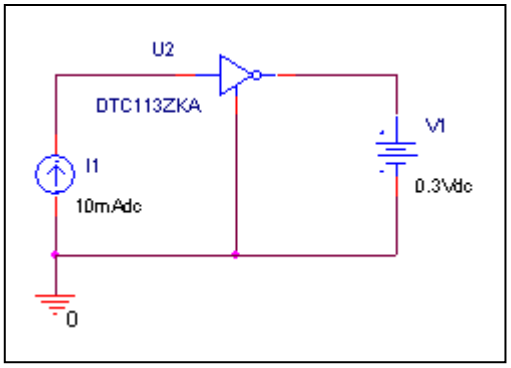
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient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

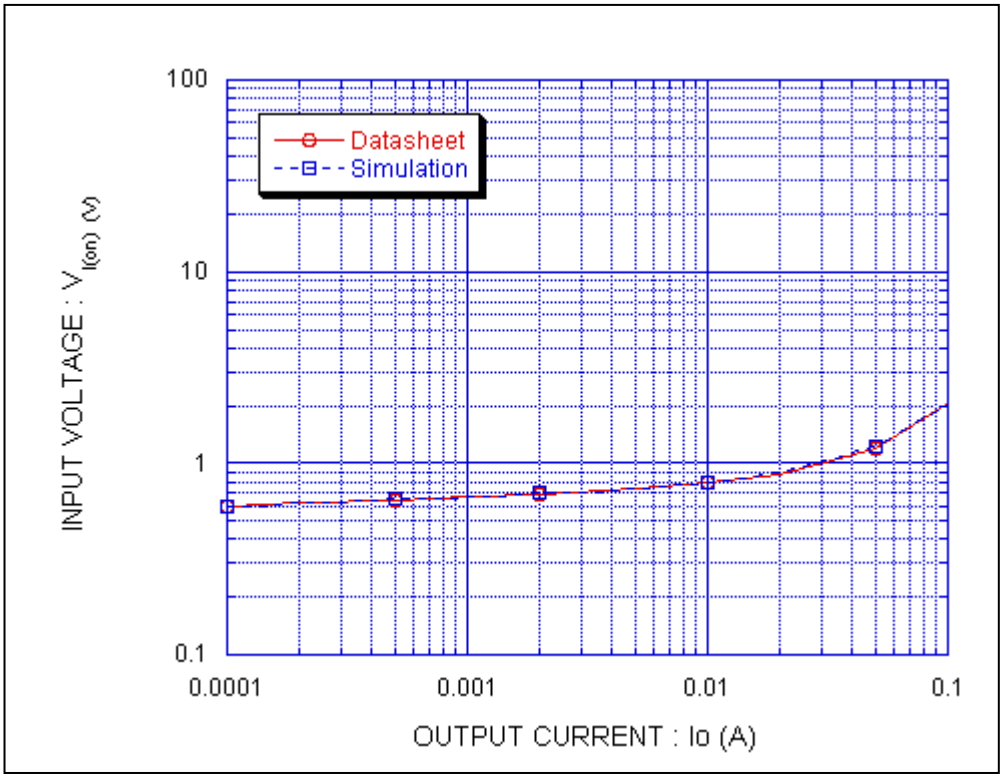


Evaluation circuit



Comparison Graph

Circuit Simulation Result



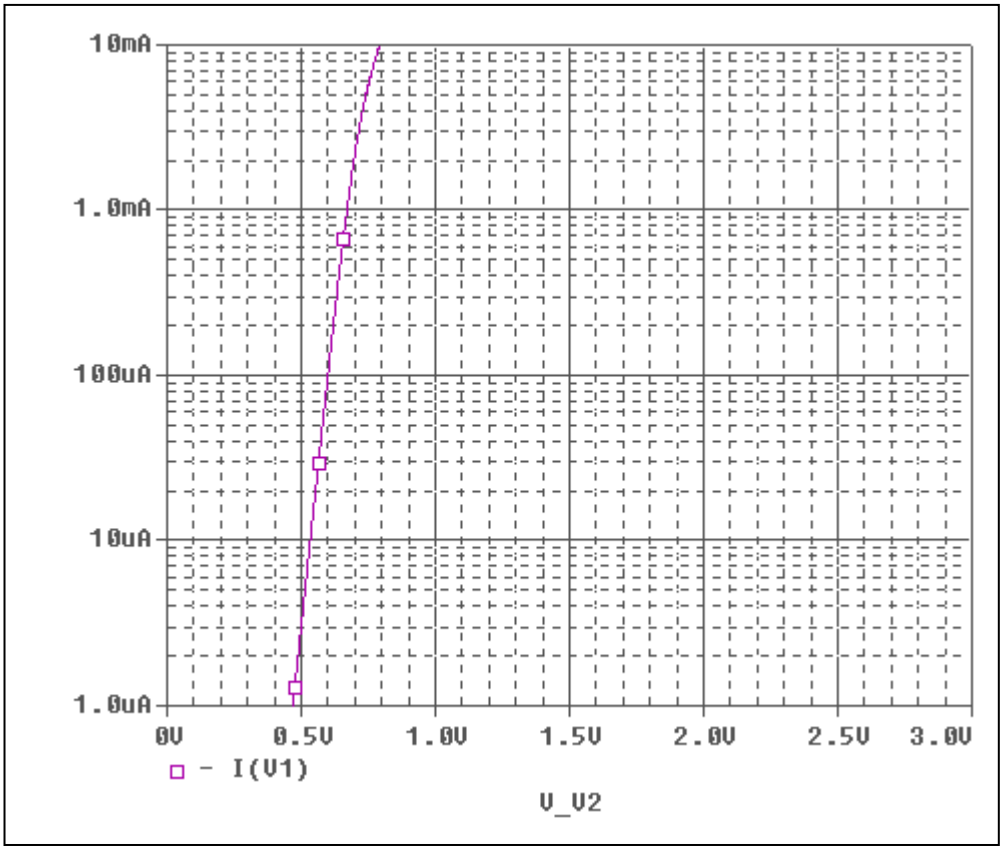
Simulation Result

Condition @ Vce = 0.3 V

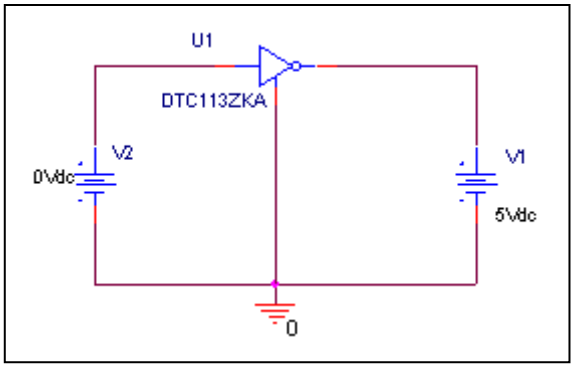
Ic(A)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
100u	600m	599.799m	-0.03350
200u	620m	620.860m	0.13871
500u	640m	648.826m	1.37906
1m	670m	671.969m	0.29388
2m	690m	698.343m	1.20913
5m	740m	744.355m	0.58851
10m	790m	797.920m	1.00253
20m	880m	893.614m	1.54705
50m	1.2	1.2185	1.54167
100m	2.1	2.0217	-3.72857

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

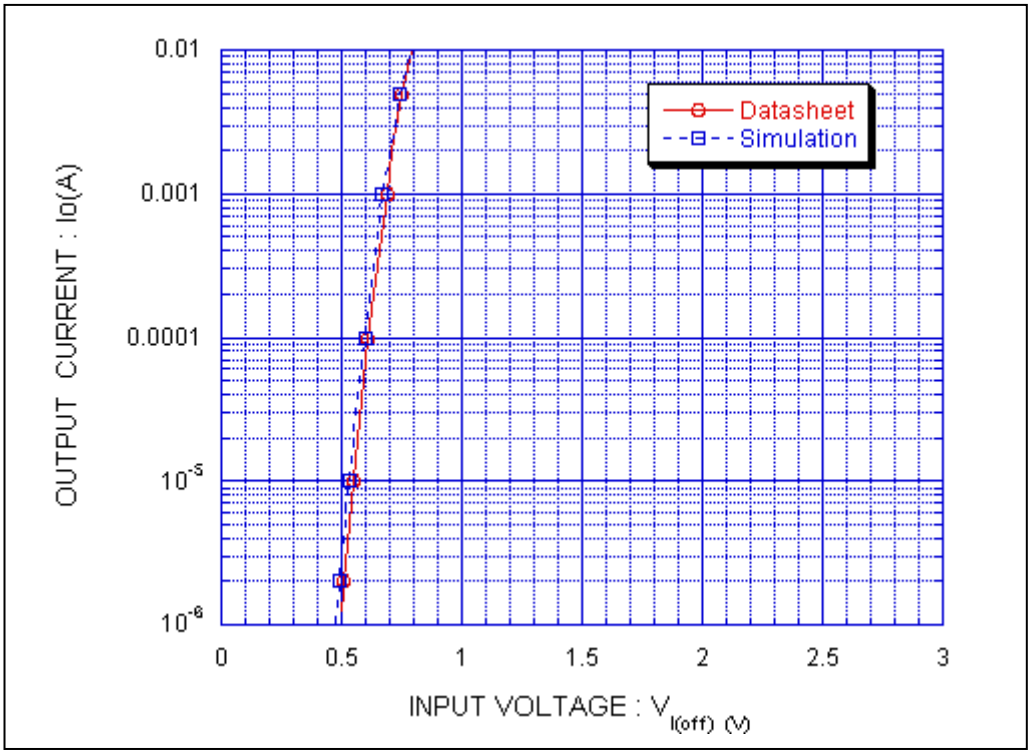


Evaluation circuit



Comparison Graph

Circuit Simulation Result



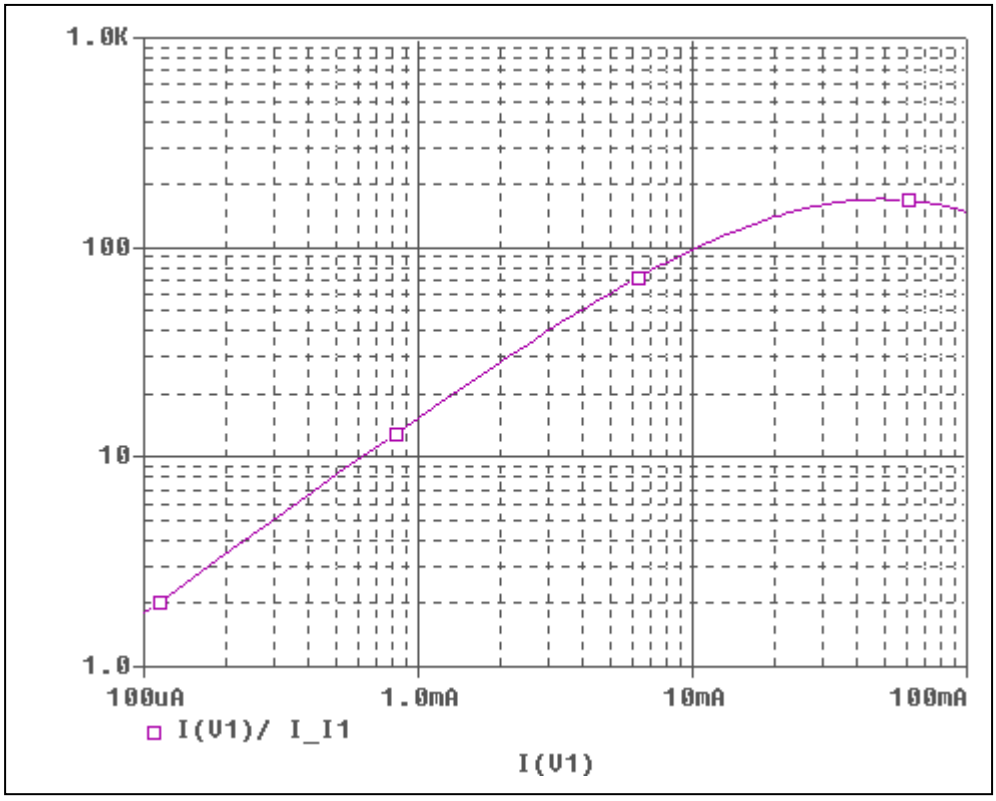
Simulation Result

Condition @ Vce = 5 V

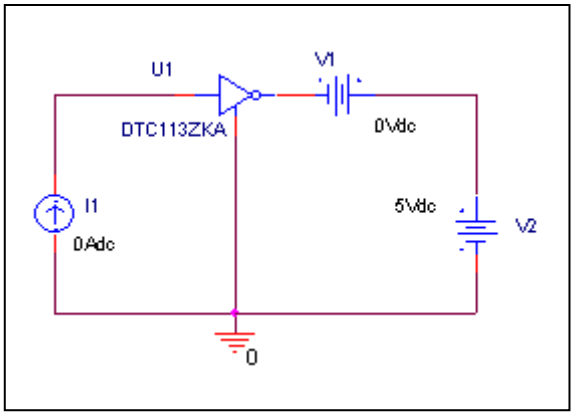
Ic(A)	$V_{I(OFF)}$ (V)		Error (%)
	Datasheet	Simulation	
1u	0.49	0.4680	-4.48980
2u	0.51	0.488431	-4.22922
5u	0.53	0.513689	-3.07755
10u	0.55	0.533431	-3.01255
20u	0.57	0.553906	-2.82351
50u	0.59	0.579301	-1.81339
100u	0.61	0.599416	-1.73508
200u	0.63	0.619893	-1.60429
500u	0.67	0.647846	-3.30657
1m	0.69	0.670939	-2.76246
2m	0.71	0.697213	-1.80099
5m	0.75	0.743151	-0.91320
10m	0.79	0.793309	0.41886

DC current gain vs. output current

Circuit simulation result

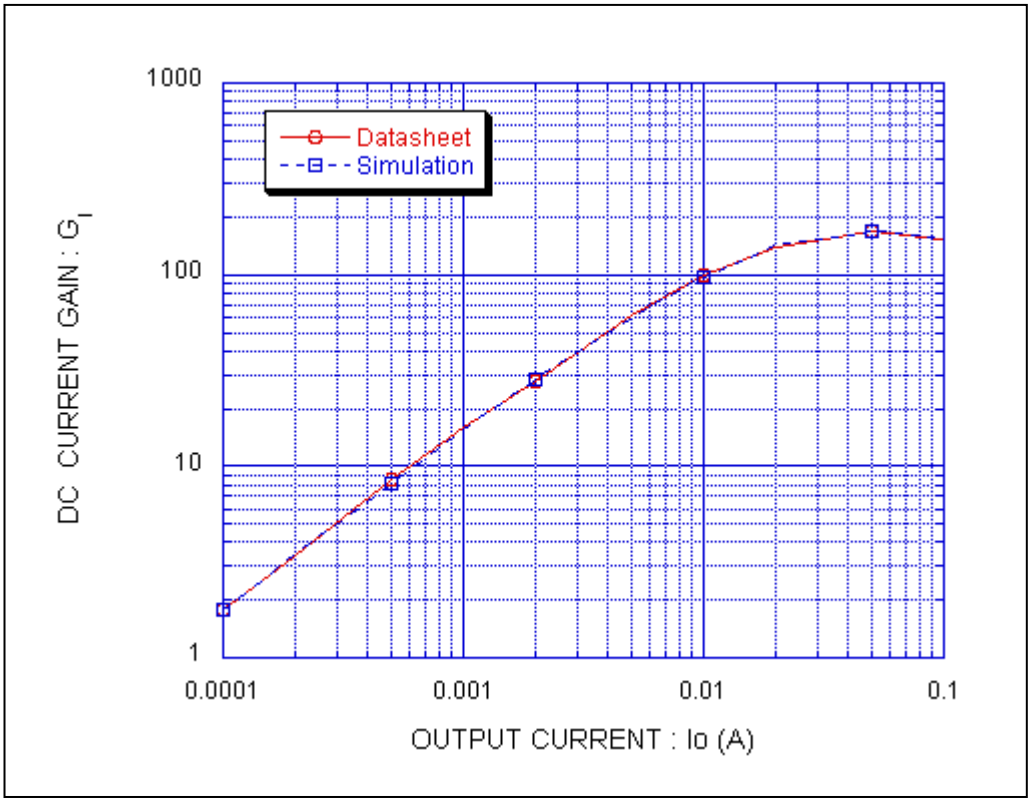


Evaluation circuit



Comparison Graph

Circuit Simulation Result



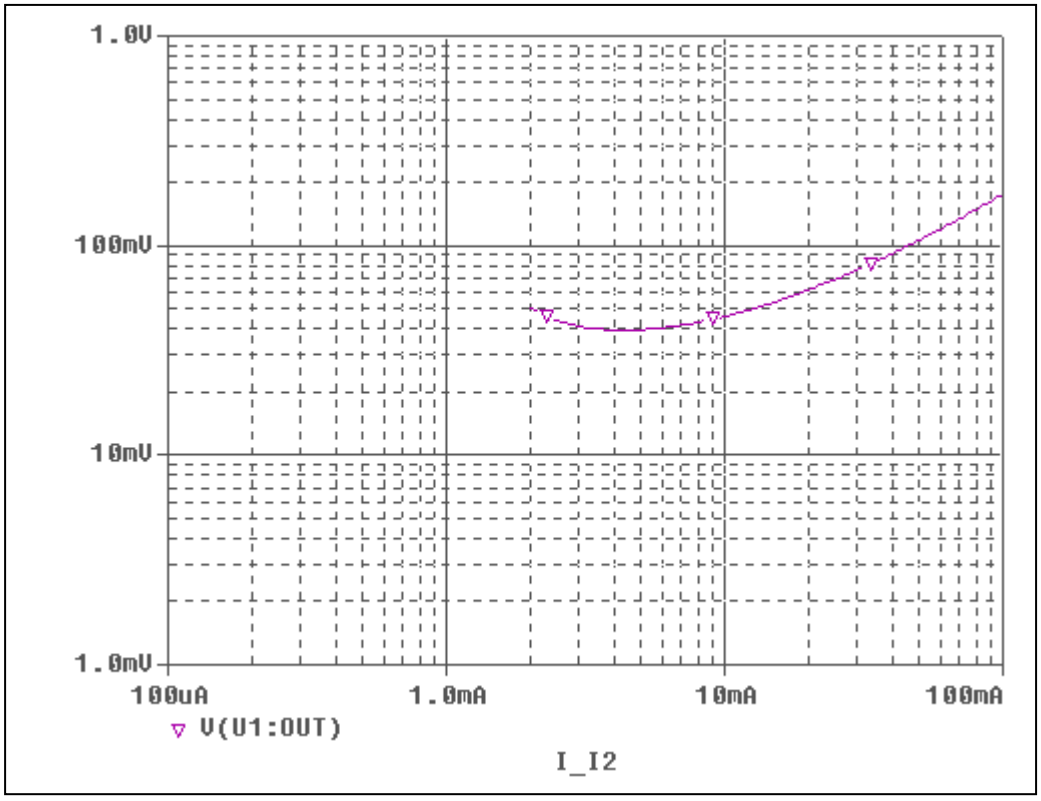
Simulation Result

Condition @ Vce = 5 V

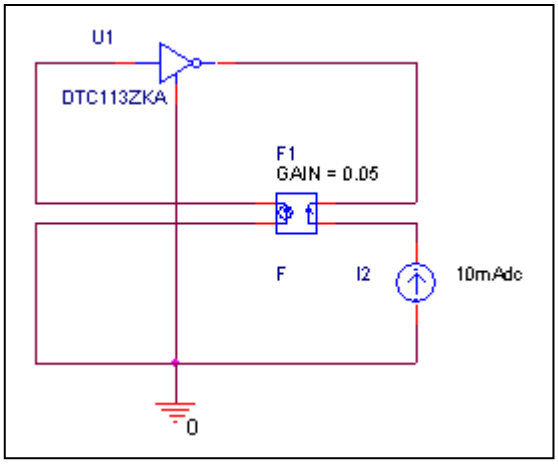
Ic(A)	hFE		Error (%)
	Datasheet	Simulation	
100u	1.8	1.8019	0.10556
200u	3.4	3.4562	1.65294
500u	8.5	8.2019	-3.50706
1m	16	15.439	-3.50625
2m	28	28.665	2.37500
5m	61	60.780	-0.36066
10m	100	98.284	-1.71600
20m	140	141.126	0.80429
50m	170	170.234	0.13765
100m	150	147.918	-1.38800

Output voltage VS. output current

Circuit simulation result

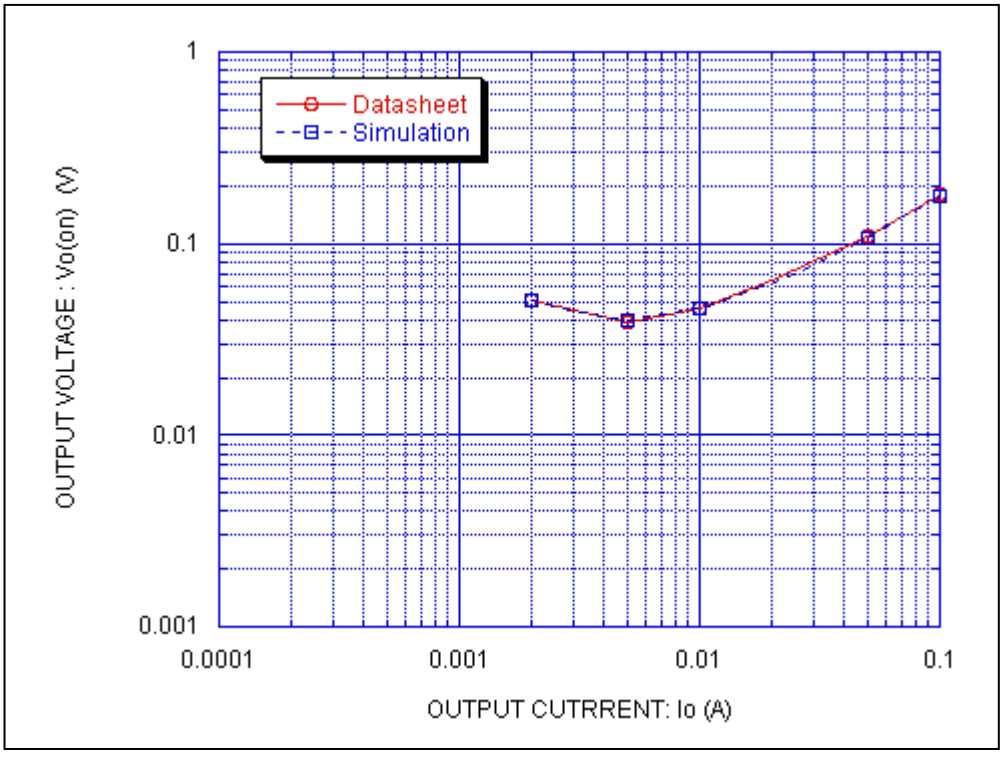


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ I_C/I_B = 20

Ic(A)	V_{CE} (sat)		Error (%)
	Datasheet	Simulation	
2m	51m	50.625m	-0.73529
5m	39m	39.740m	1.89744
10m	46m	46.003m	0.00652
20m	64m	61.736m	-3.53750
50m	110m	106.943m	-2.77909
100m	180m	176.586m	-1.89667