

Device Modeling Report

COMPONENTS: BRT
PART NUMBER: RN1104FT
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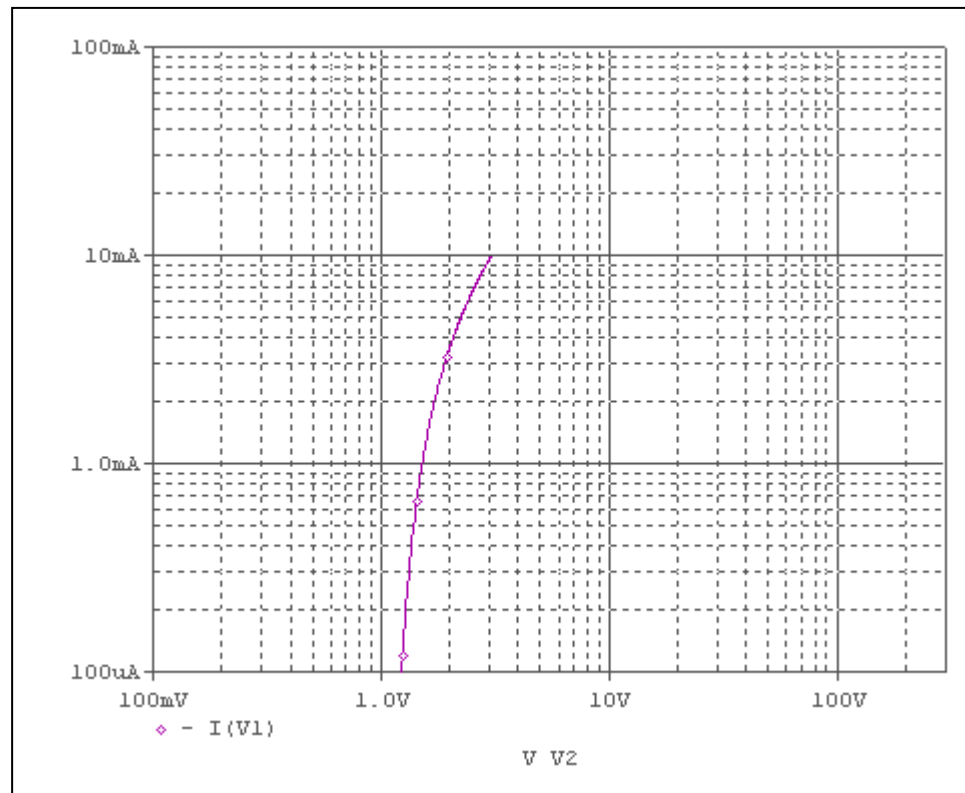


Bee Technologies Inc.

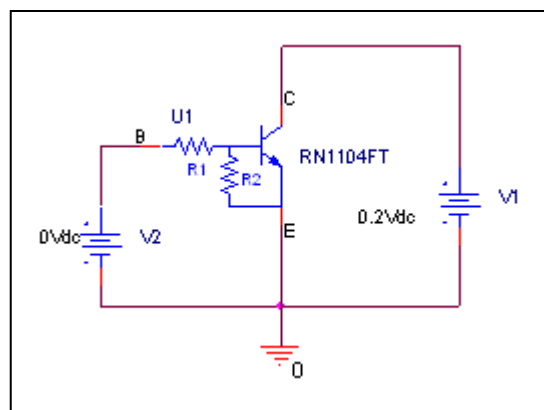
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient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

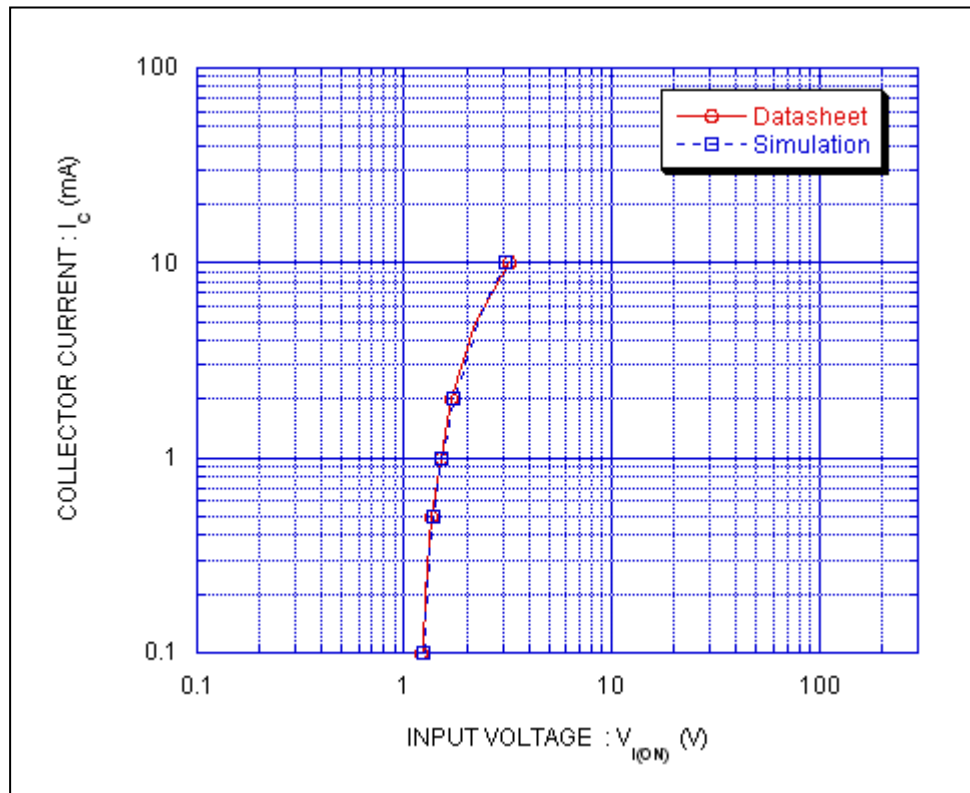


Evaluation circuit



Comparison Graph

Circuit Simulation Result



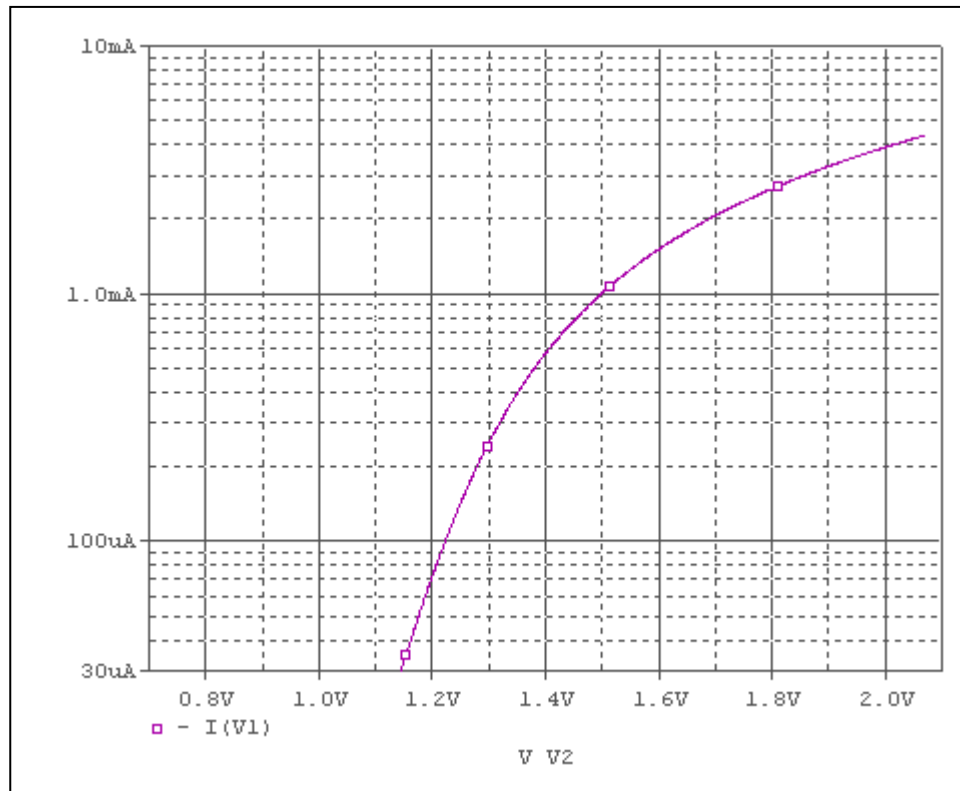
Simulation Result

Condition @ $V_{ce} = 0.2$ V

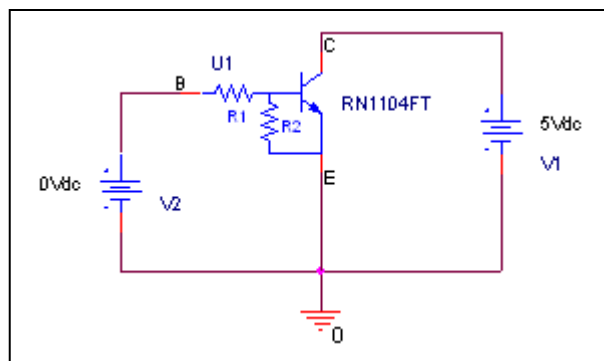
I_c (mA)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
0.1	1.2	1.2266	2.2167
0.2	1.25	1.2853	2.8240
0.5	1.35	1.3897	2.9407
1	1.5	1.5139	0.9267
2	1.7	1.7148	0.8706
5	2.2	2.2358	1.6273
10	3.2	3.0500	-4.6875

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

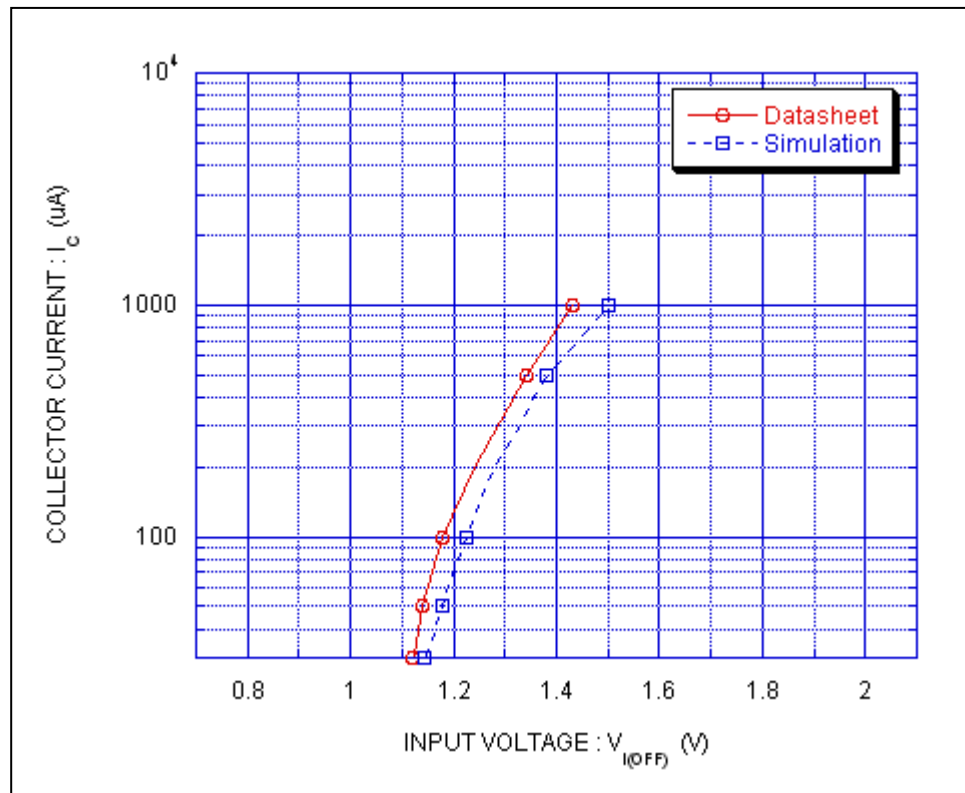


Evaluation circuit



Comparison Graph

Circuit Simulation Result



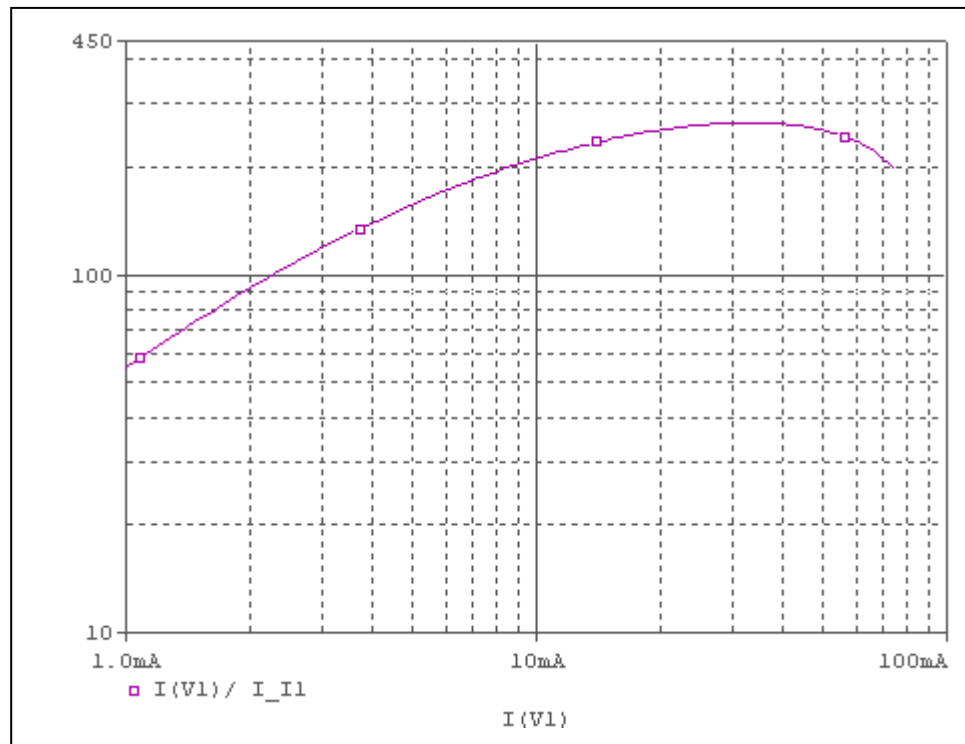
Simulation Result

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

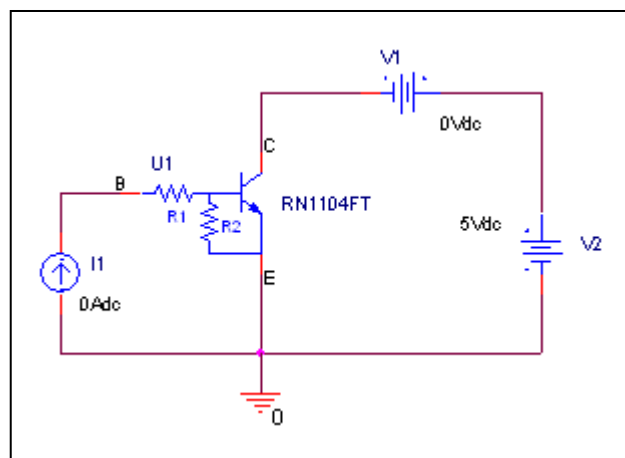
Ic(uA)	V _{I(Off)} (V)		Error (%)
	Datasheet	Simulation	
30	1.12	1.1447	2.2054
50	1.14	1.1768	3.2281
100	1.18	1.2234	3.6780
200	1.24	1.2796	3.1935
500	1.34	1.3807	3.0373
1000	1.43	1.4995	4.8601

DC current gain vs. output current

Circuit simulation result

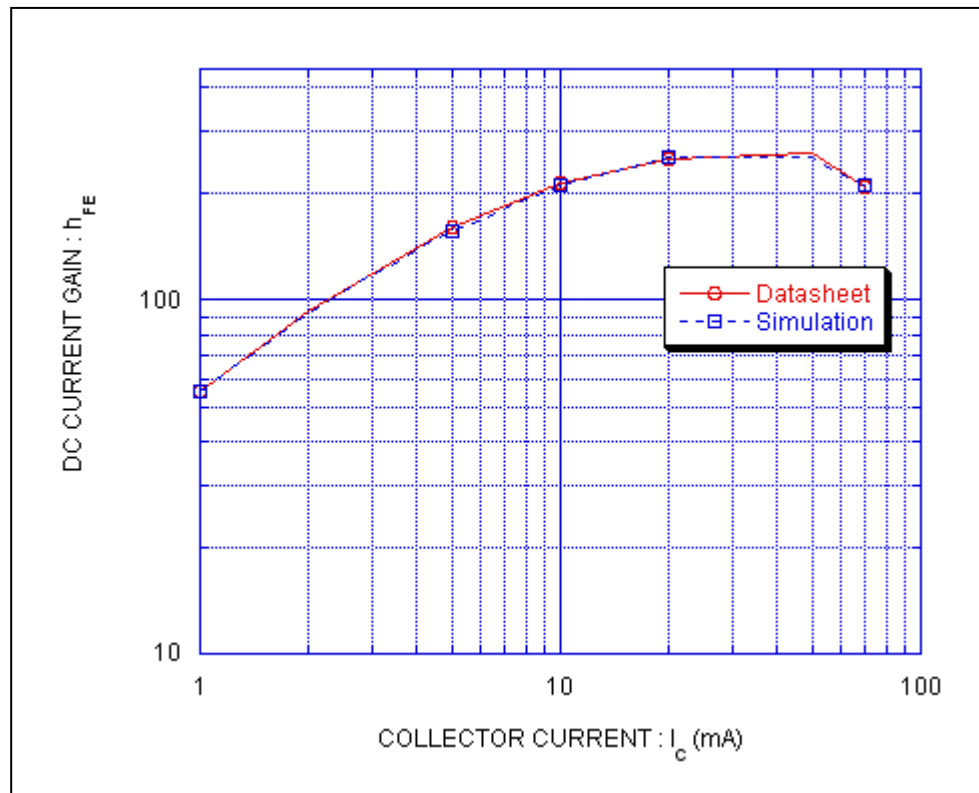


Evaluation circuit



Comparison Graph

Circuit Simulation Result



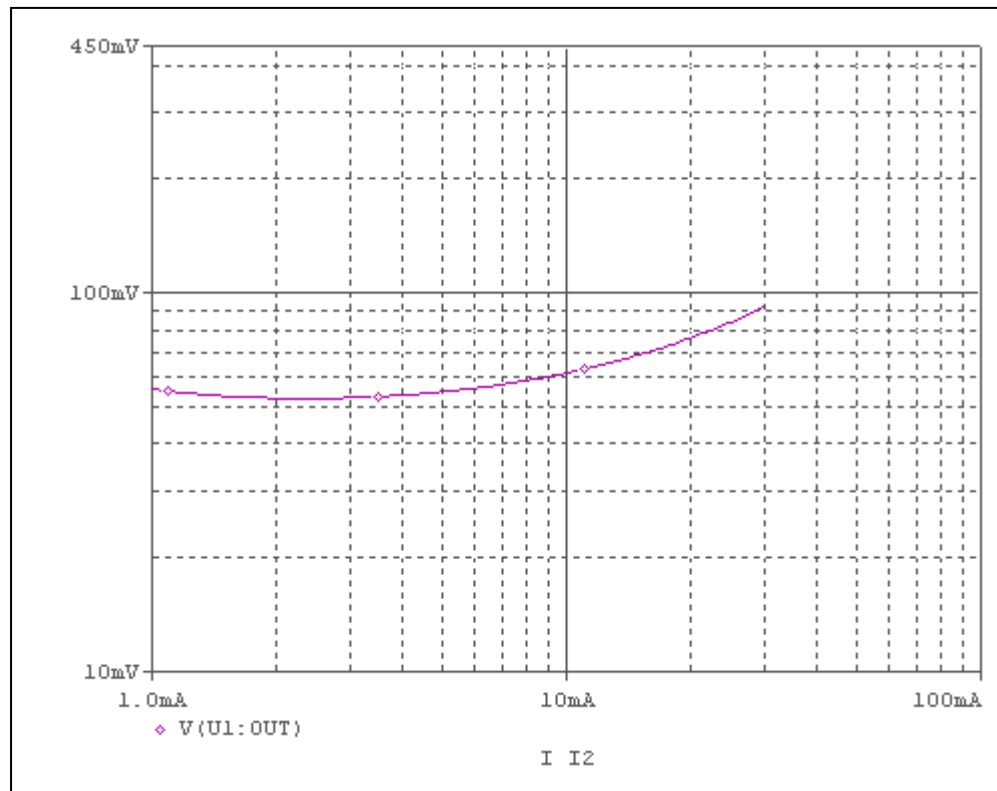
Simulation Result

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

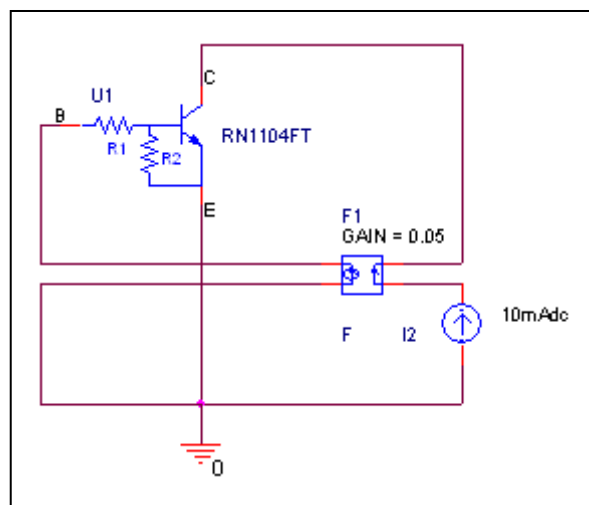
$I_C(\text{mA})$	hFE		Error (%)
	Datasheet	Simulation	
1	55	55.125	0.2273
2	93	91.363	-1.7602
5	160	157.468	-1.5825
10	215	211.326	-1.7088
20	250	253.909	1.5636
50	260	253.342	-2.5608
70	210	210.962	0.4581

Output voltage VS. output current

Circuit simulation result

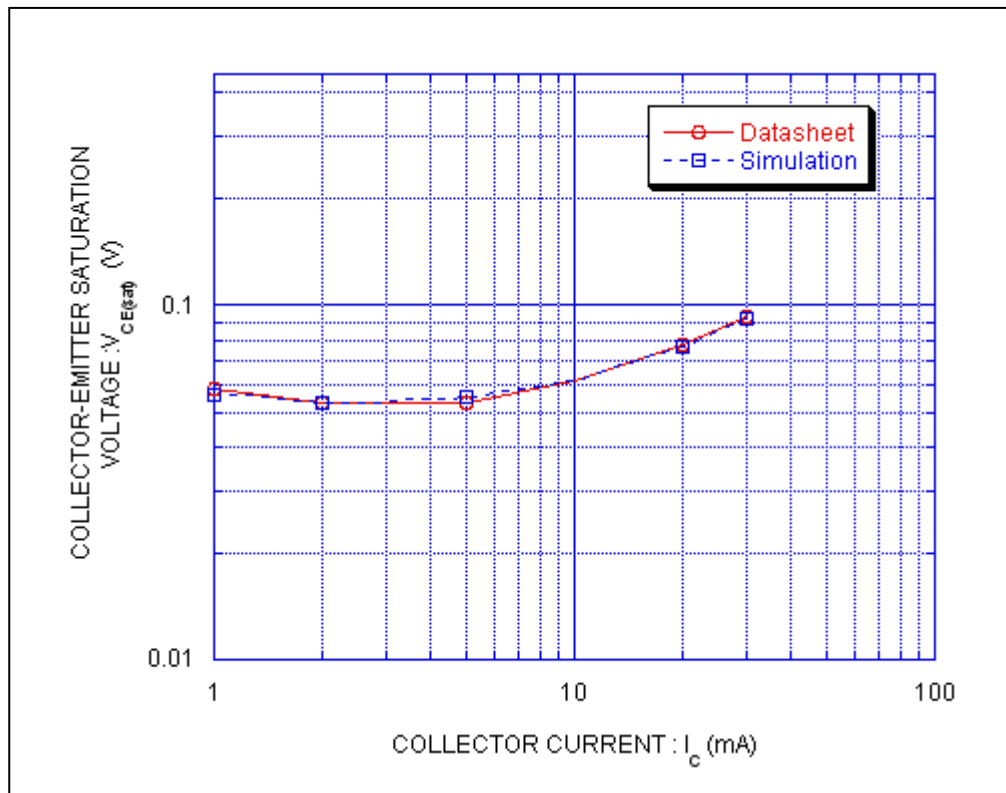


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ $I_C/I_B = 20$

I_C (mA)	V_{CE} (sat) (mV)		Error (%)
	Datasheet	Simulation	
1	0.058	0.055821	-3.7569
2	0.053	0.052789	-0.3981
5	0.053	0.054862	3.5132
10	0.061	0.061499	0.8180
20	0.077	0.076219	-1.0143
30	0.093	0.091800	-1.2903