

Device Modeling Report

COMPONENTS: BRT
PART NUMBER: RN1102FT
MANUFACTURER: TOSHIBA

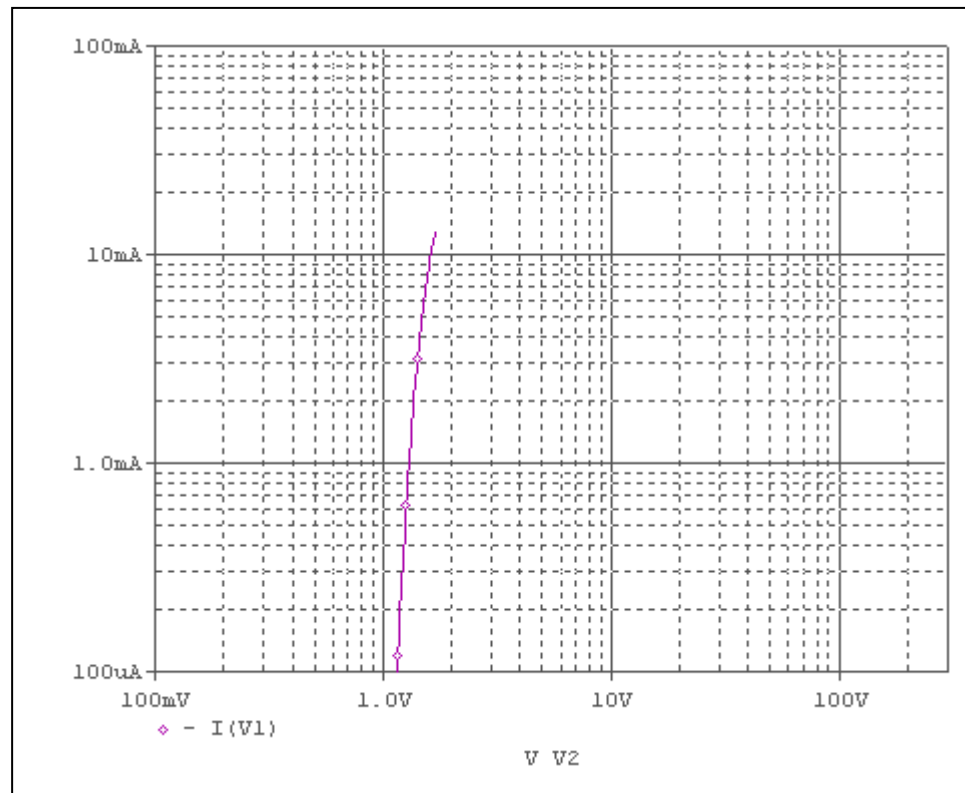


Bee Technologies Inc.

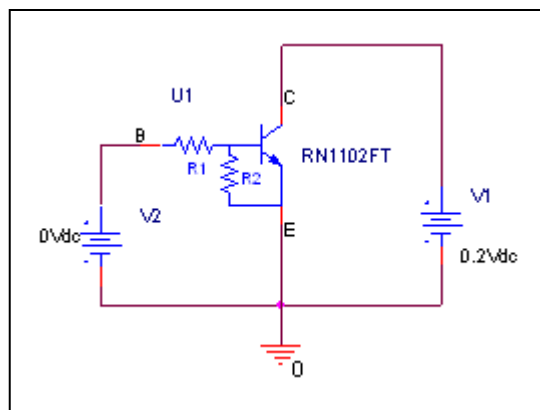
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient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

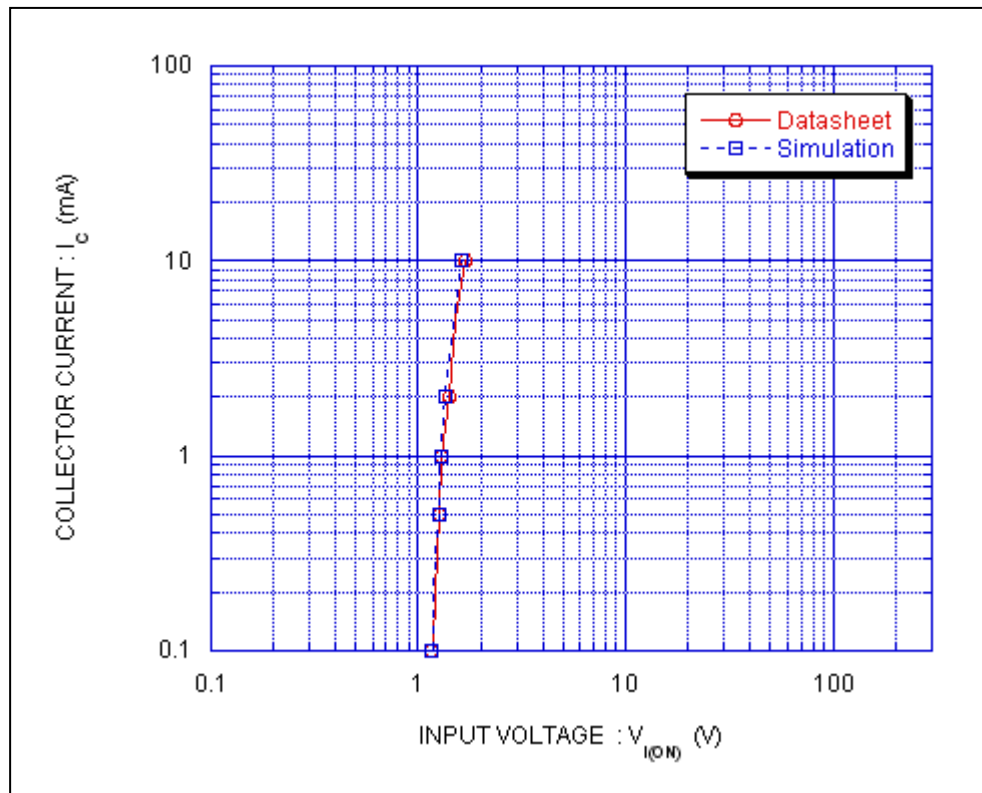


Evaluation circuit



Comparison Graph

Circuit Simulation Result



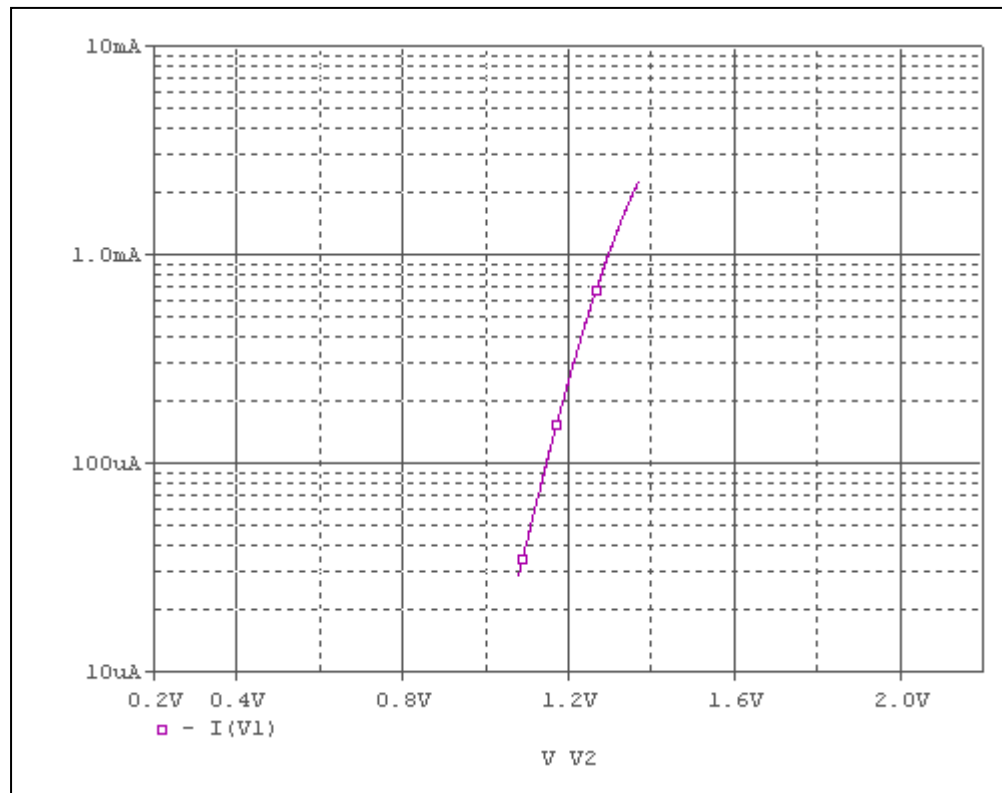
Simulation Result

Condition @ $V_{ce} = 0.2$ V

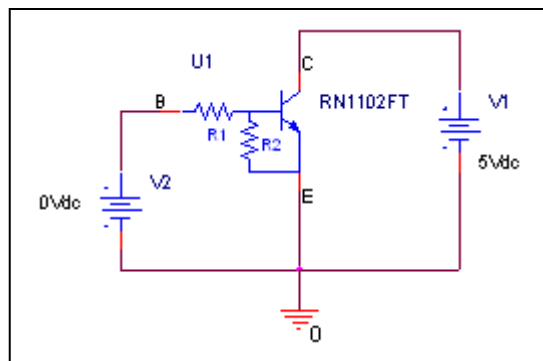
I_c (mA)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
0.1	1.15	1.1497	-0.0261
0.2	1.2	1.1910	-0.7500
0.5	1.25	1.2494	-0.0480
1	1.3	1.3011	0.0846
2	1.4	1.3655	-2.4643
5	1.5	1.4803	-1.3133
10	1.7	1.6210	-4.6471

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

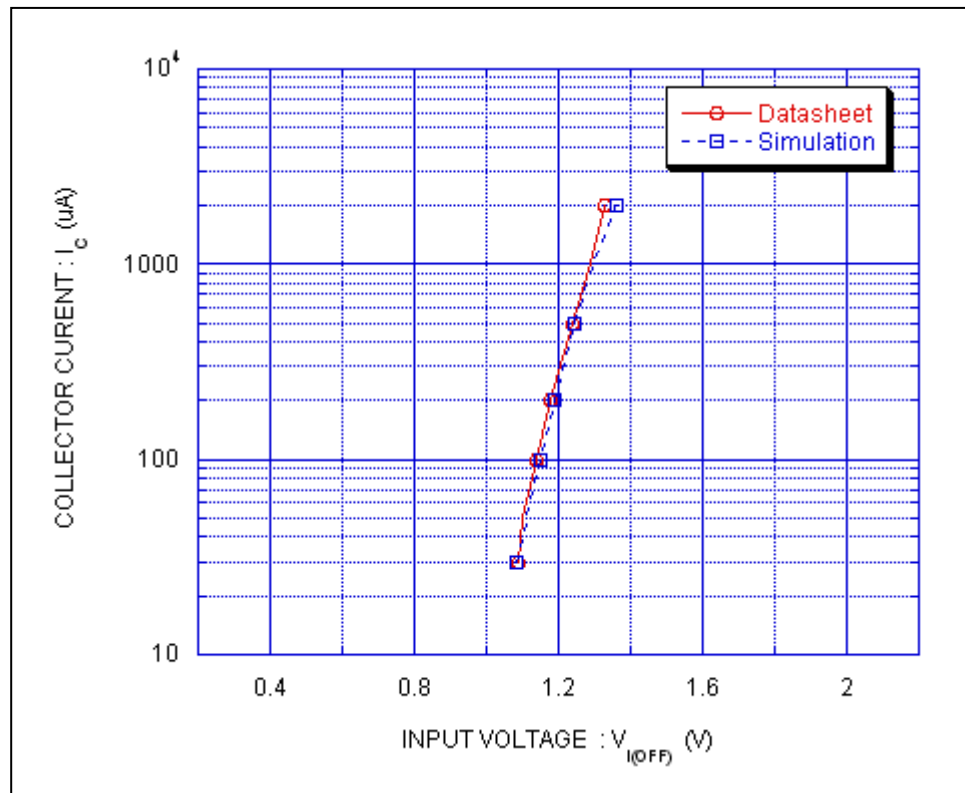


Evaluation circuit



Comparison Graph

Circuit Simulation Result



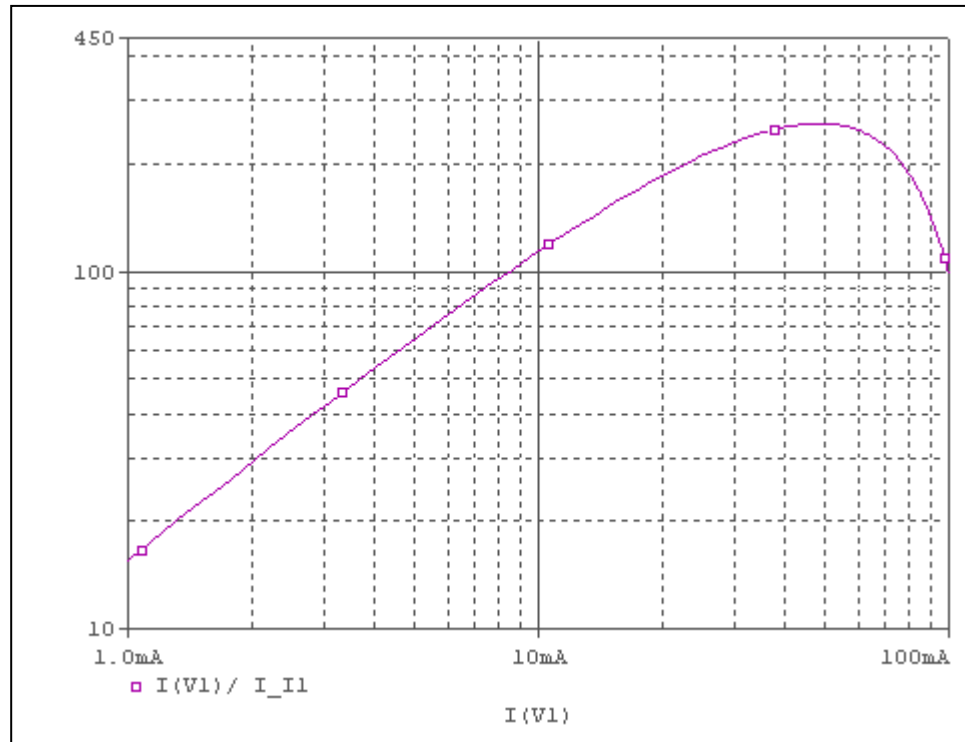
Simulation Result

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

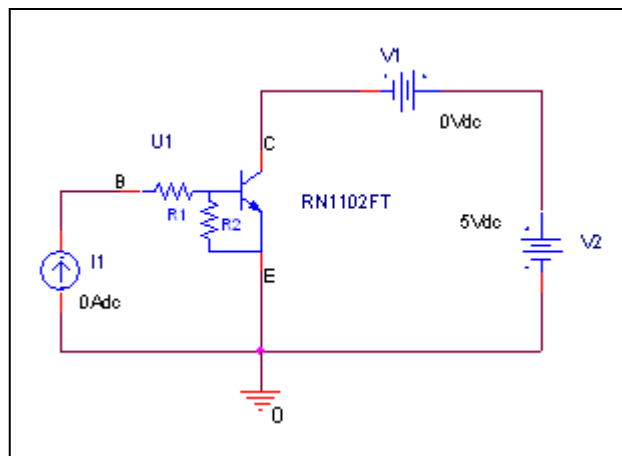
$I_c(\mu\text{A})$	$V_{I(Off)} (\text{V})$		Error (%)
	Datasheet	Simulation	
30	1.09	1.0823	-0.7064
50	1.1	1.1089	0.8091
100	1.14	1.1483	0.7281
200	1.18	1.1880	0.6780
500	1.24	1.2457	0.4597
1000	1.29	1.2966	0.5116
2000	1.33	1.3596	2.2256

DC current gain vs. output current

Circuit simulation result

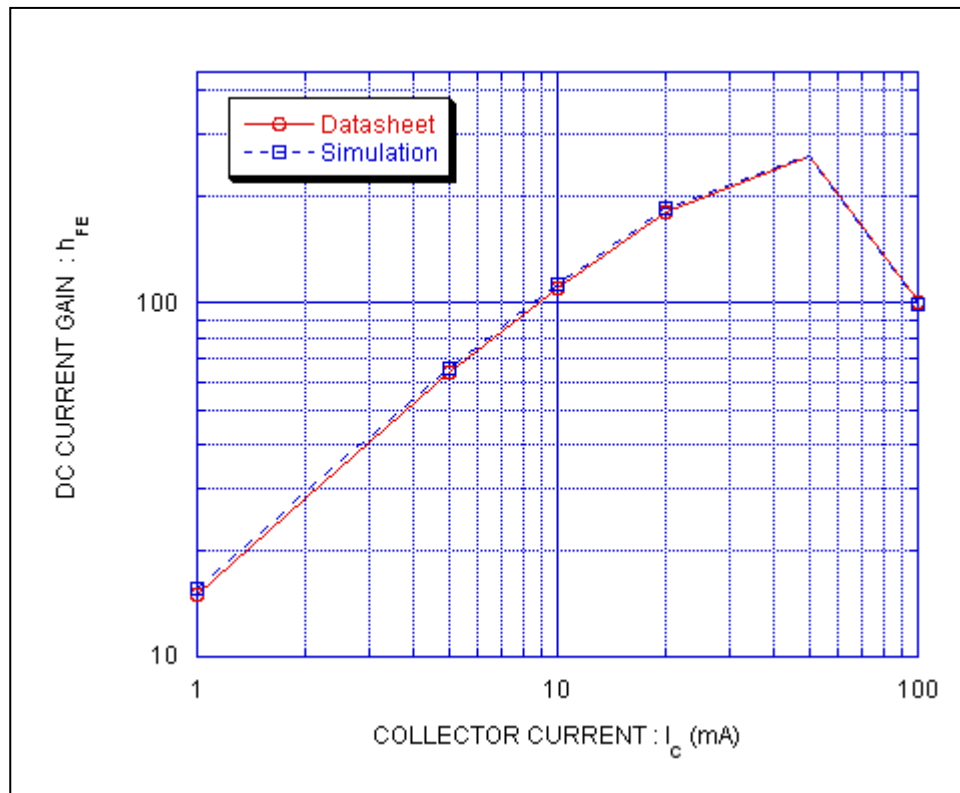


Evaluation circuit



Comparison Graph

Circuit Simulation Result



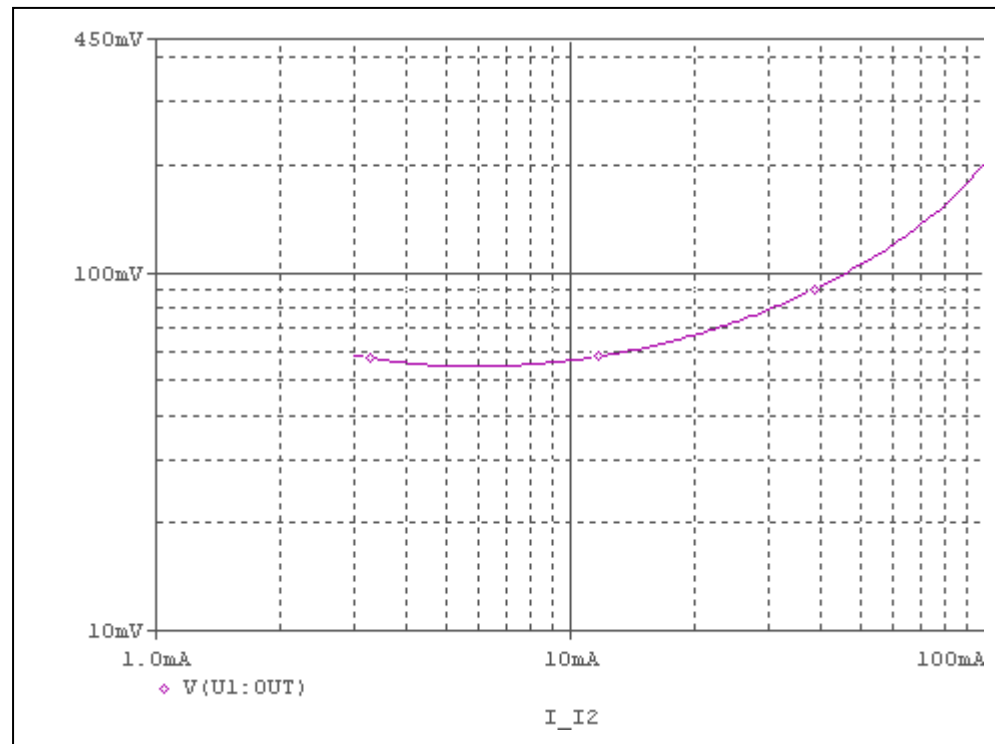
Simulation Result

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

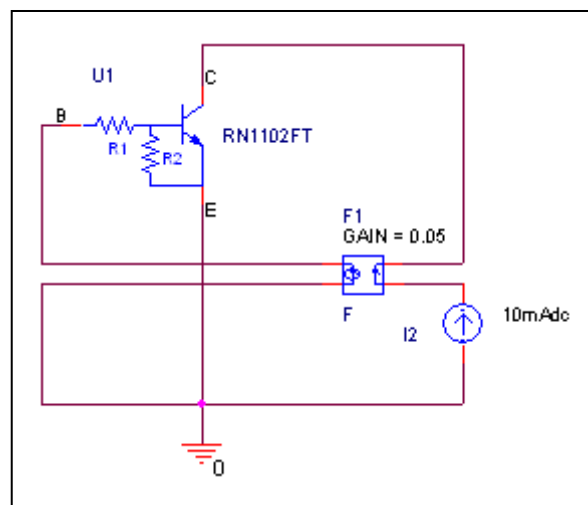
Ic(mA)	hFE		Error (%)
	Datasheet	Simulation	
1	15	15.567	3.7800
2	28	29.301	4.6464
5	64	64.976	1.5250
10	110	113.625	3.2955
20	180	184.460	2.4778
50	260	258.966	-0.3977
100	100	99.756	-0.2440

Output voltage VS. output current

Circuit simulation result

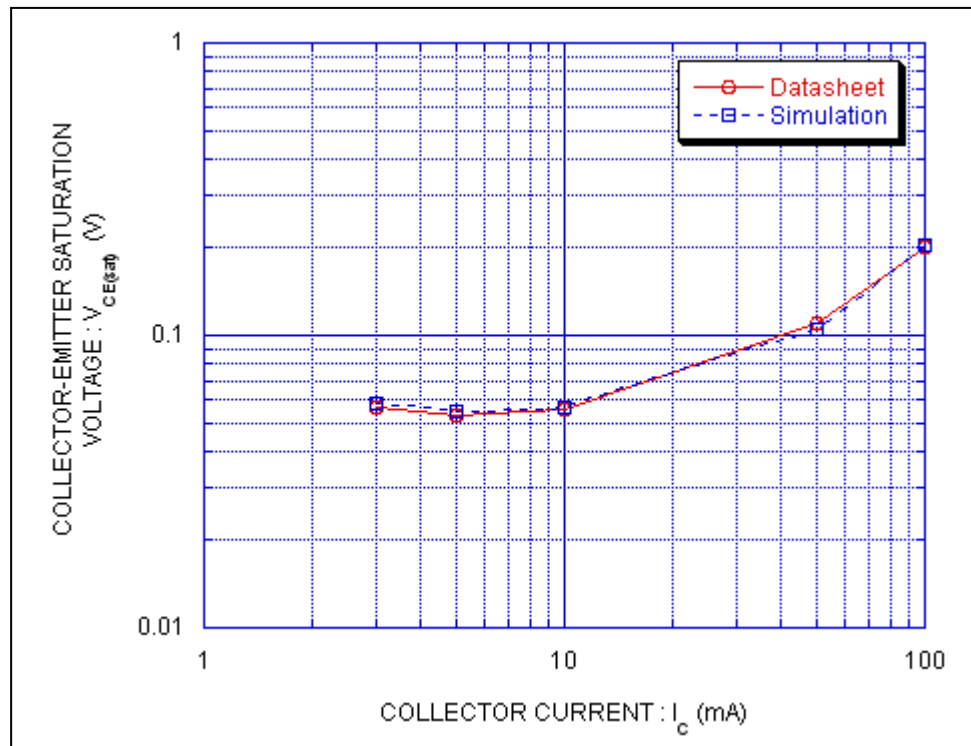


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ $I_C/I_B = 20$

Ic(mA)	V _{CE} (sat) (mV)		Error (%)
	Datasheet	Simulation	
3	0.057	0.058947	3.4158
5	0.053	0.054940	3.6604
10	0.056	0.056905	1.6161
50	0.110	0.105166	-4.3945
100	0.2	0.202719	1.3595