

Device Modeling Report

COMPONENTS: BRT
PART NUMBER: RN1115FV
MANUFACTURER: TOSHIBA

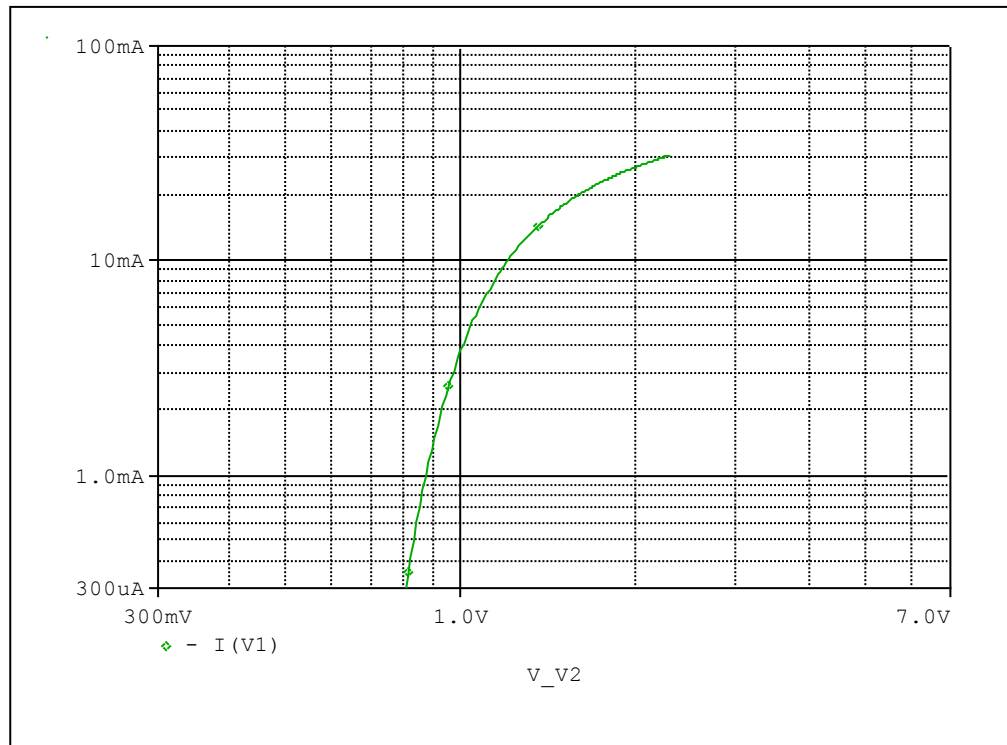


Bee Technologies Inc.

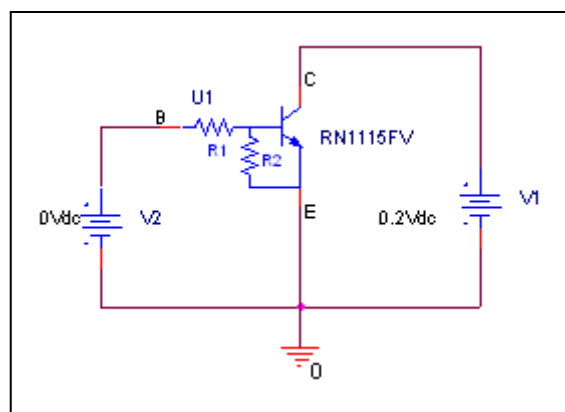
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient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

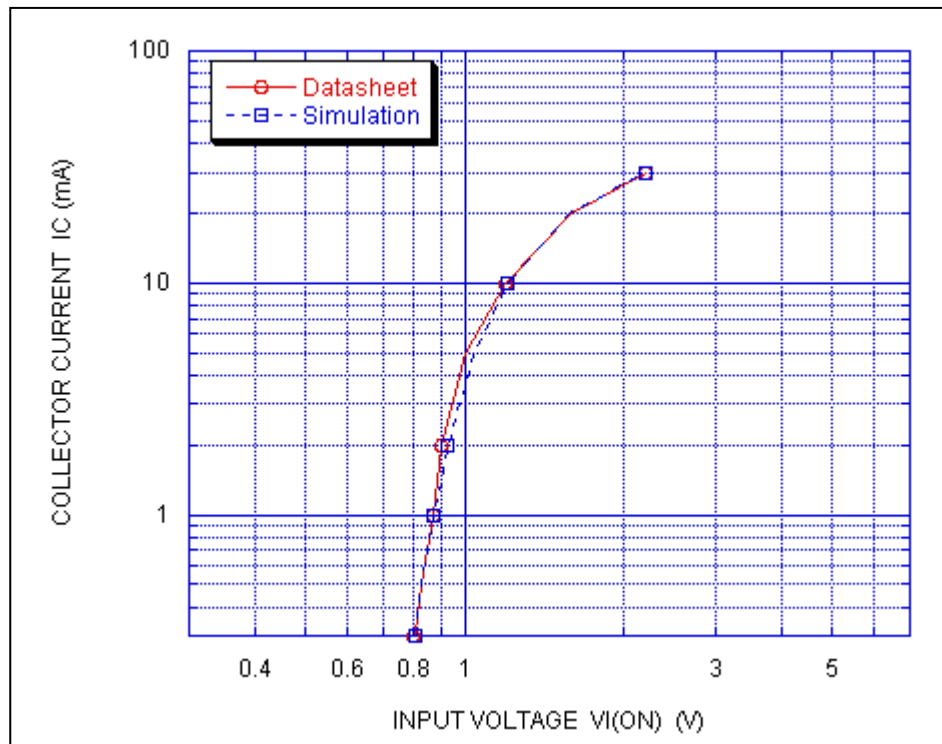


Evaluation circuit



Comparison Graph

Circuit Simulation Result



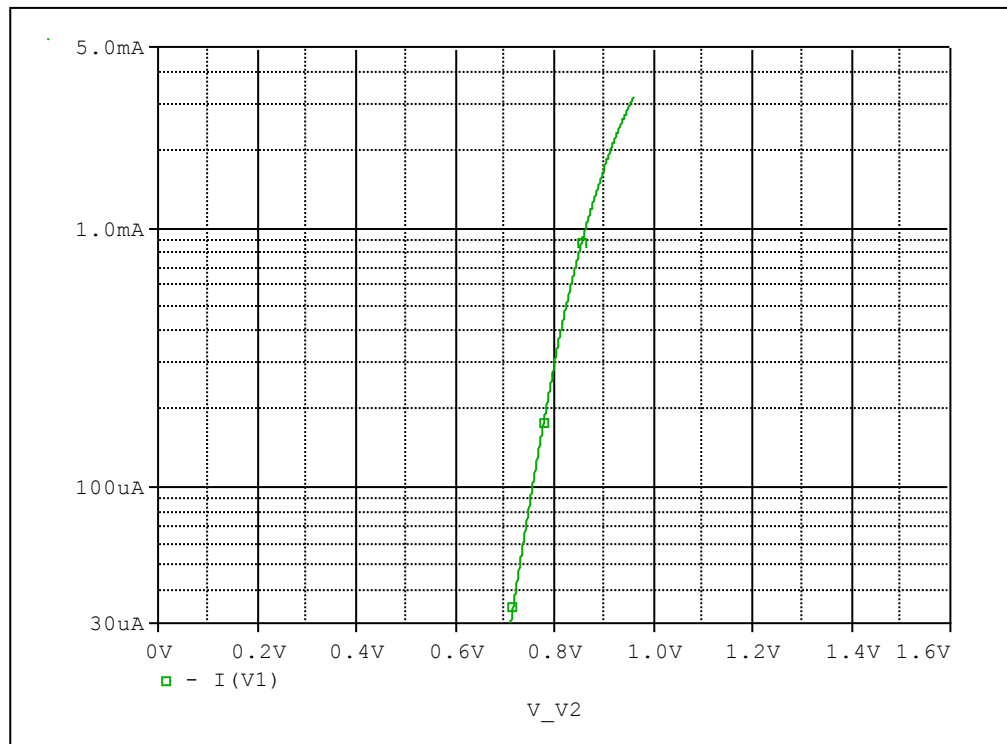
Simulation Result

Condition @ $V_{ce} = 0.2$ V

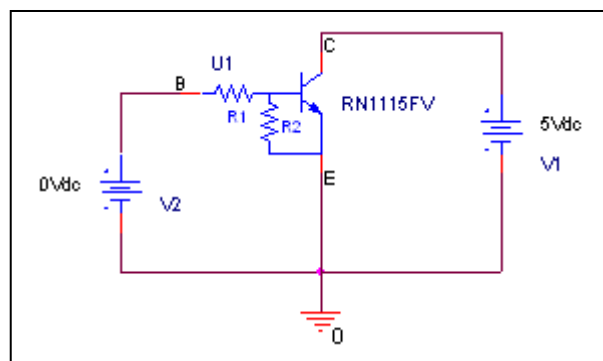
I_C (mA)	$V_{I(ON)}$ (V)		Error (%)
	Datasheet	Simulation	
0.3	0.8	0.804246	0.53075
0.5	0.83	0.829635	-0.04398
1	0.87	0.870918	0.10552
2	0.9	0.926172	2.90800
5	1.0	1.0409	4.09000
10	1.2	1.2063	0.52500
20	1.6	1.5854	-0.91250
30	2.2	2.2150	0.68182

Output current vs. input voltage (OFF characteristics)

Circuit simulation result

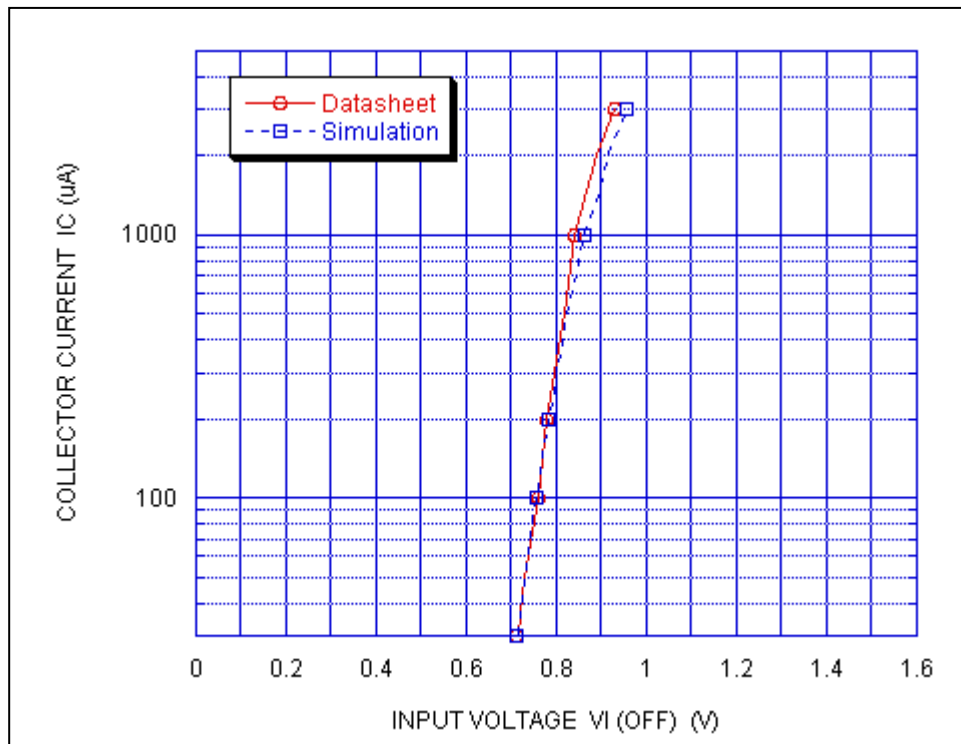


Evaluation circuit



Comparison Graph

Circuit Simulation Result



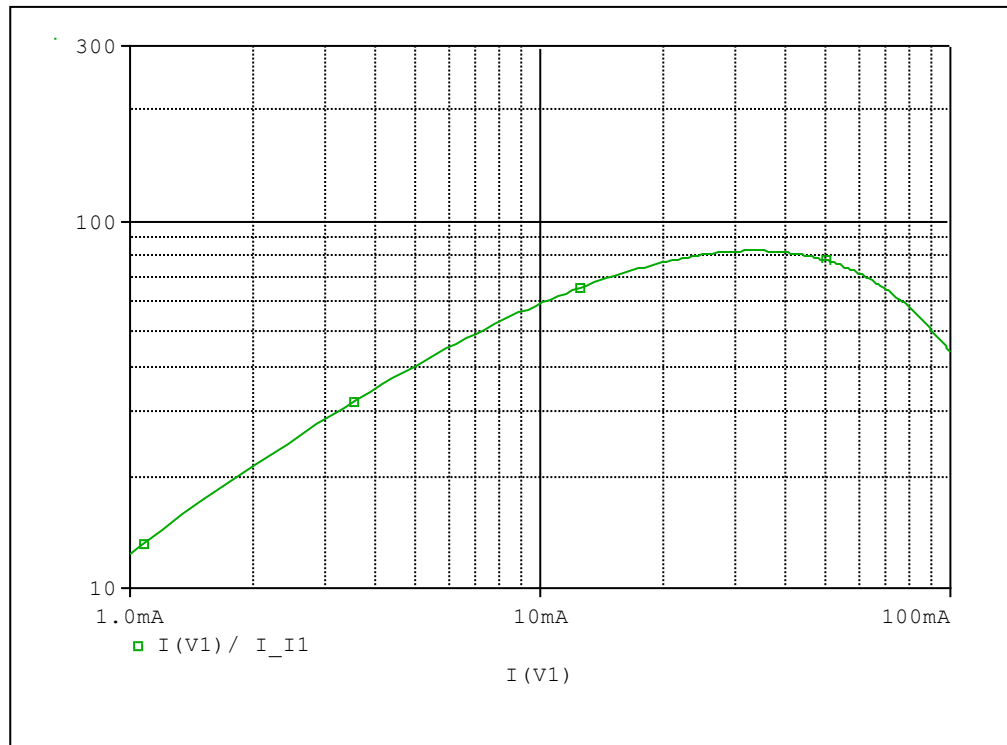
Simulation Result

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

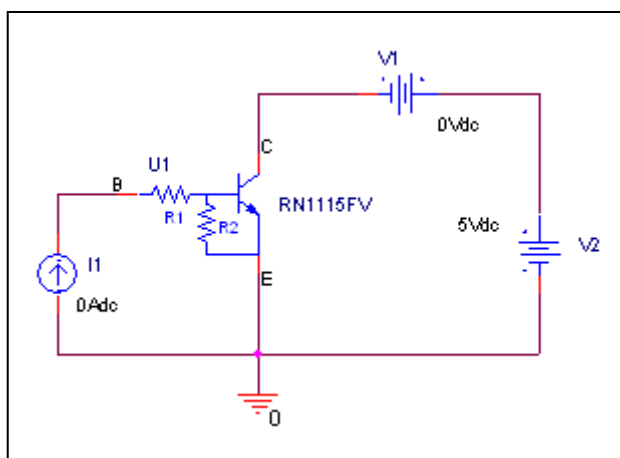
Ic(uA)	V _{I(OFF)} (V)		Error (%)
	Datasheet	Simulation	
30	0.71	0.712566	0.36141
50	0.73	0.730556	0.07616
100	0.76	0.755811	-0.55118
200	0.78	0.782970	0.38077
500	0.82	0.823853	0.46988
1000	0.84	0.863590	2.80833
2000	0.89	0.915596	2.87596
3000	0.93	0.954128	2.59441

DC current gain vs. output current

Circuit simulation result

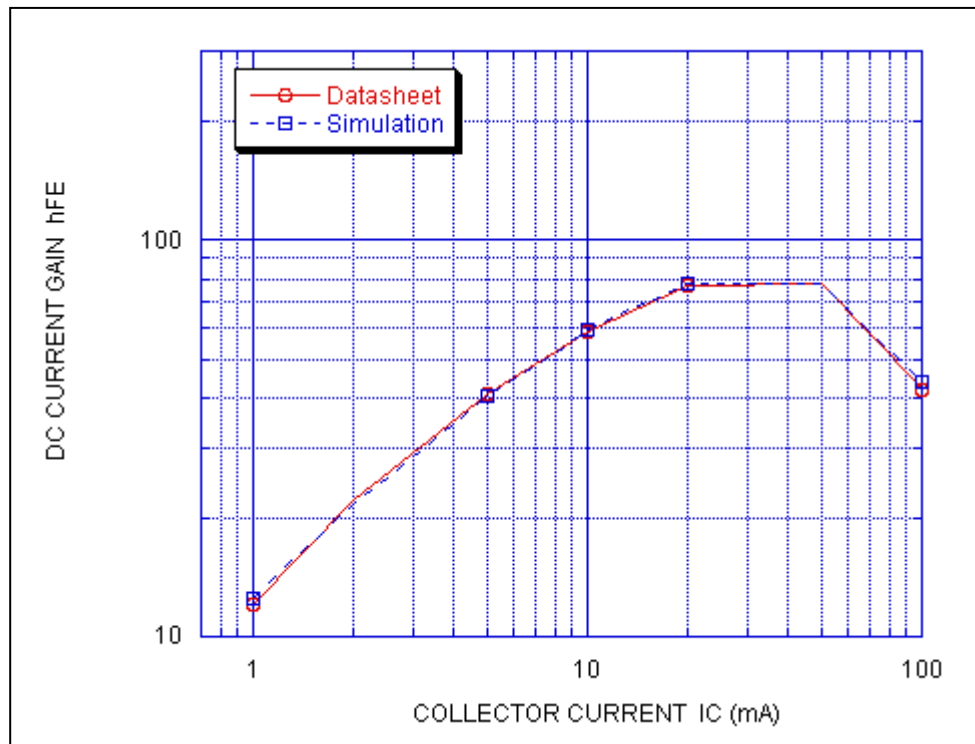


Evaluation circuit



Comparison Graph

Circuit Simulation Result



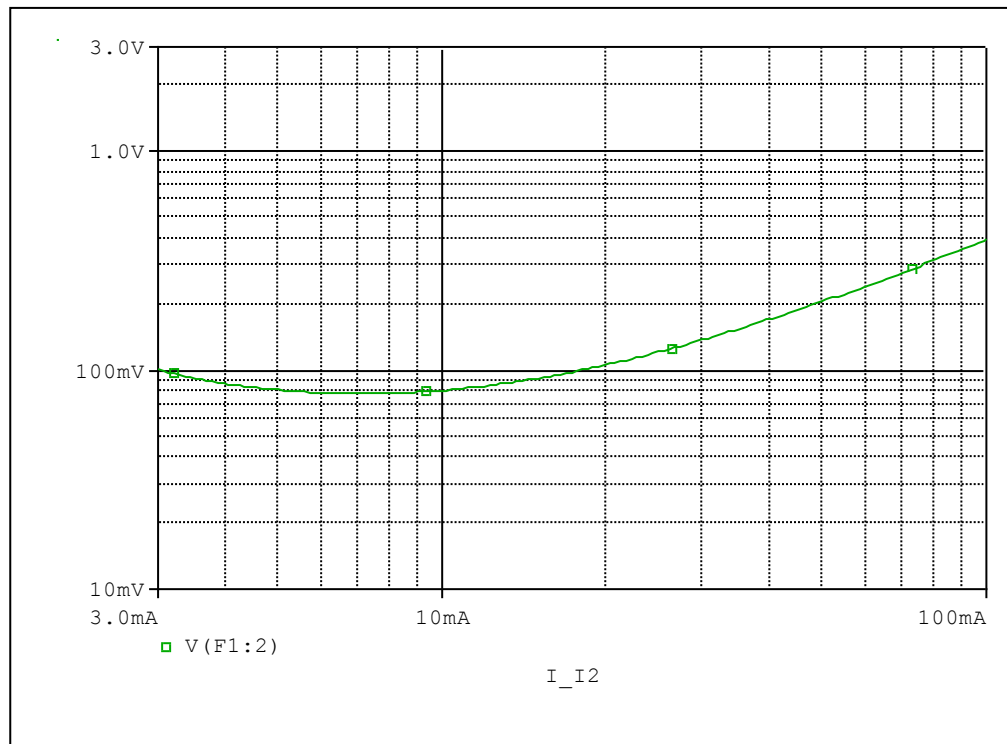
Simulation Result

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

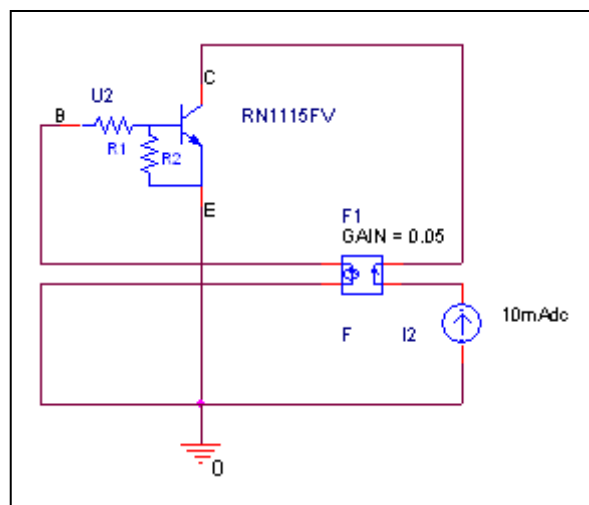
Ic(mA)	hFE		Error (%)
	Datasheet	Simulation	
1	12	12.447	3.72500
2	22	21.616	-1.74545
5	41	40.653	-0.84634
10	59	59.532	0.90169
20	77	77.315	0.40909
50	78	77.929	-0.09103
100	42	43.842	4.38571

Output voltage VS. output current

Circuit simulation result

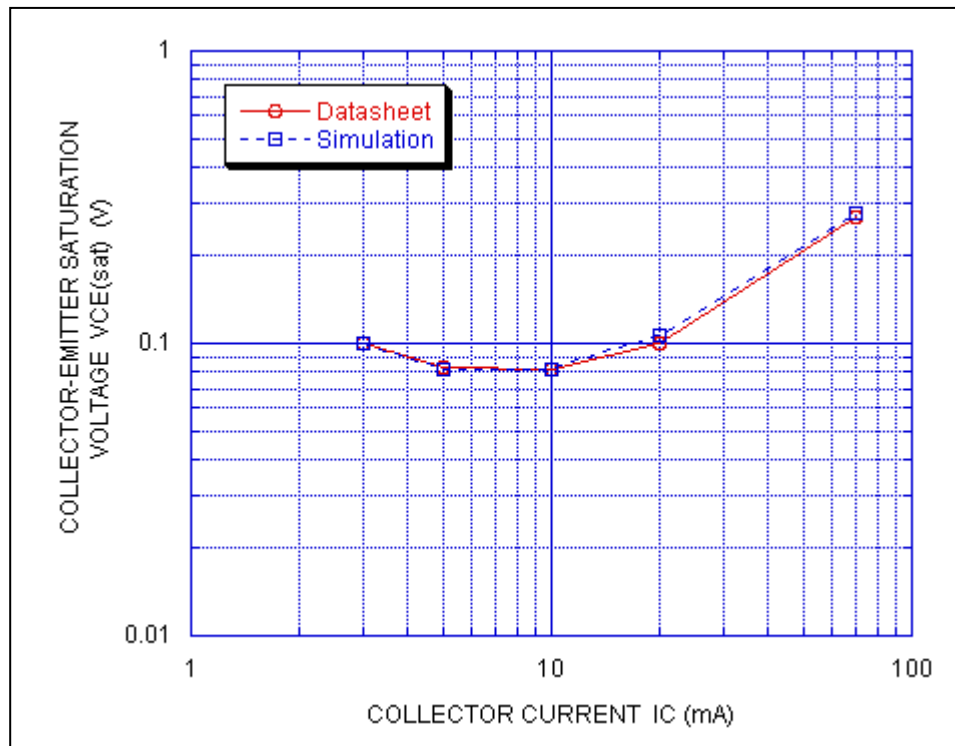


Evaluation circuit



Comparison Graph

Circuit Simulation Result



Simulation Result

Condition @ $I_C/I_B = 20$

Ic(mA)	V _{CE} (sat) (mV)		Error (%)
	Datasheet	Simulation	
3	0.1	0.100428	0.42800
5	0.083	0.081143	-2.23735
10	0.081	0.080931	-0.08519
20	0.1	0.105963	5.96300
70	0.27	0.279316	3.45037