

# Device Modeling Report

COMPONENTS: TRANSISTOR  
PART NUMBER: US6T7TR  
MANUFACTURER: ROHM

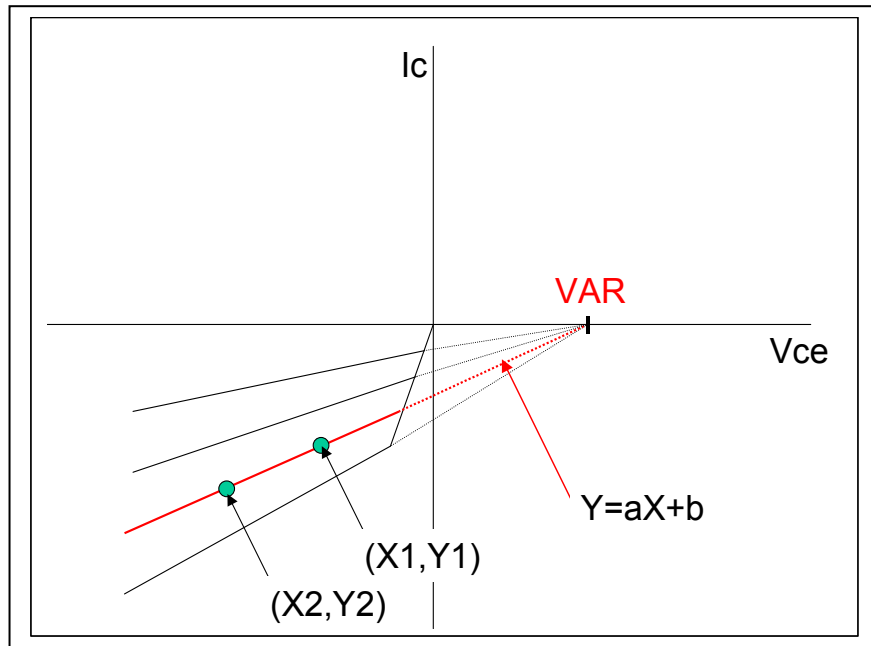
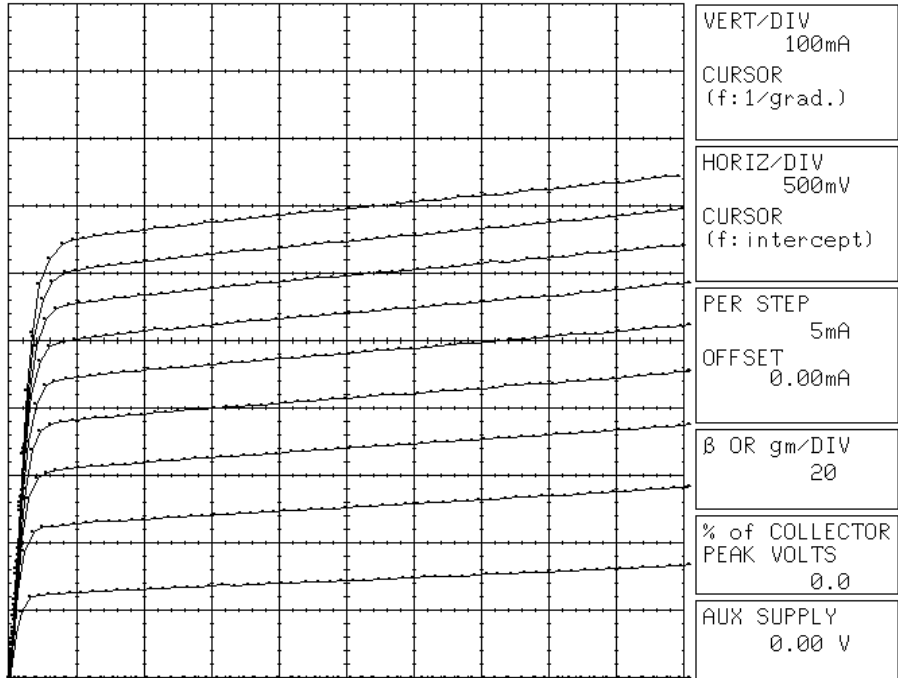


## TRANSISTOR MODEL

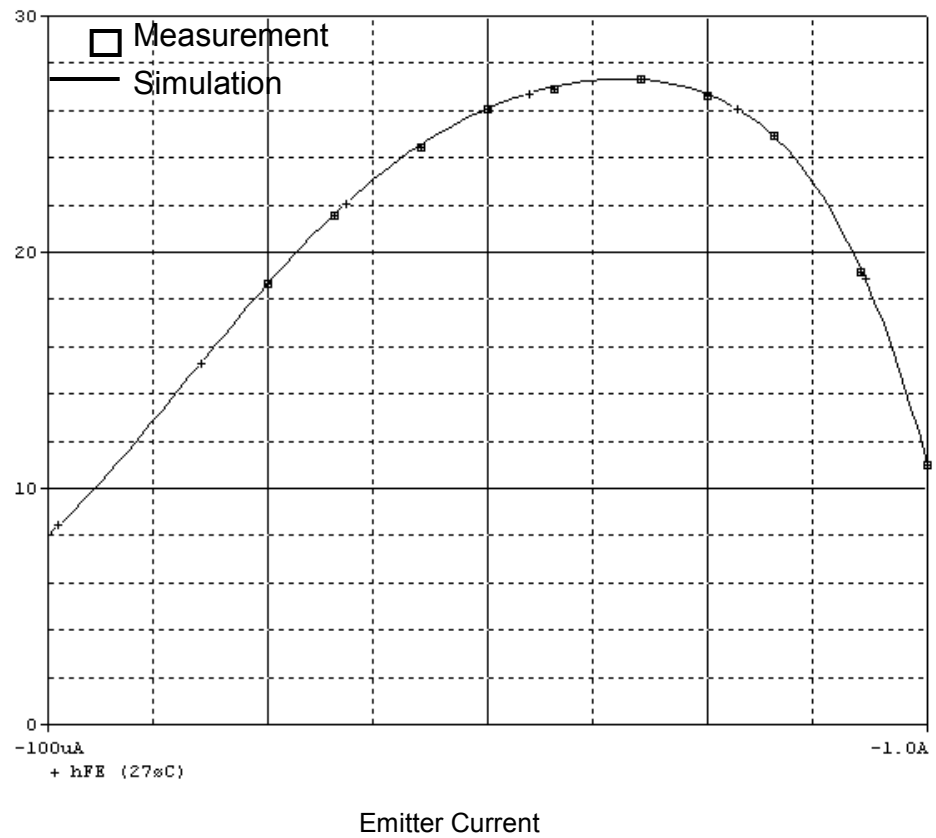
PSpice model parameter	Model description
IS	Saturation Current
BF	Ideal Maximum Forward Beta
NF	Forward Current Emission Coefficient
VAF	Forward Early Voltage
IKF	Forward Beta Roll-off Knee Current
ISE	Non-ideal Base-Emitter Diode Saturation Current
NE	Non-ideal Base-Emitter Diode Emission Coefficient
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 $f=1/2\pi*TF$
TR	Reverse Transit Time
EG	Activation Energy
XTB	Forward Beta Temperature Coefficient
XTI	Temperature Coefficient for IS

Reverse

### Reverse Early Voltage Characteristic

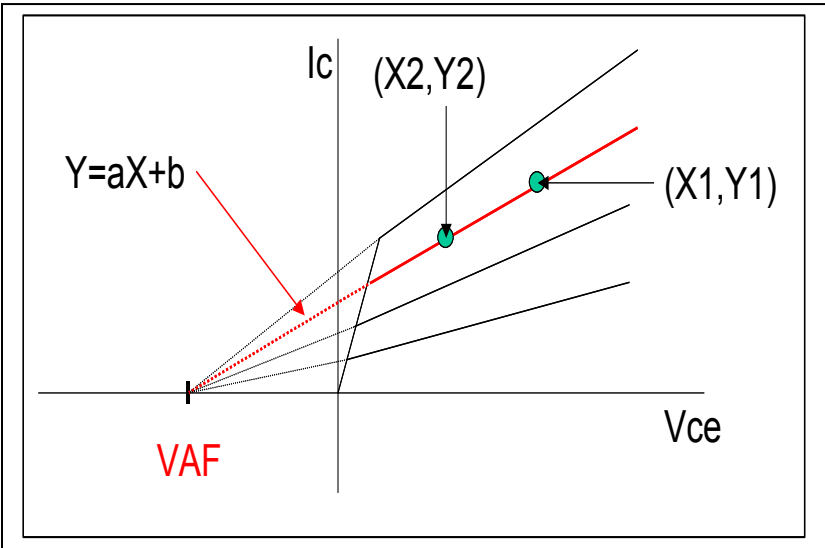
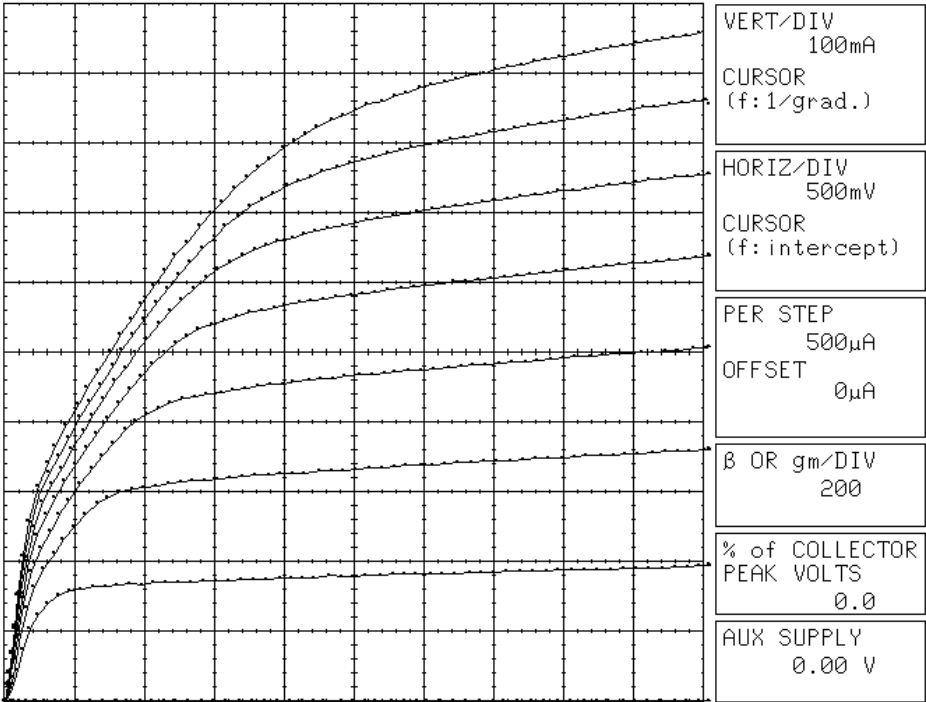


## Reverse DC Beta Characteristic ( $I_e$ vs. $h_{FE}$ )

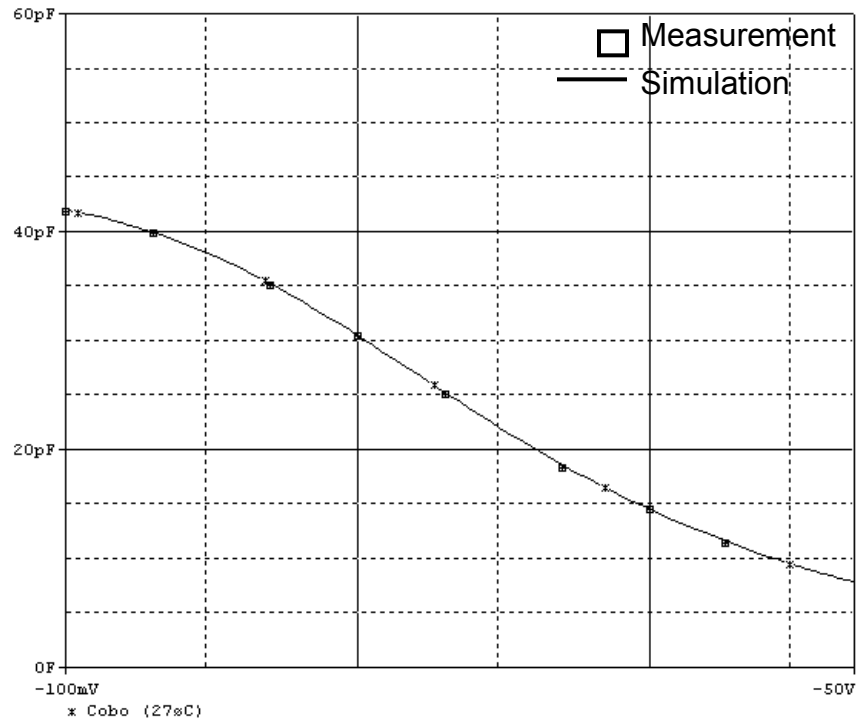


Forward

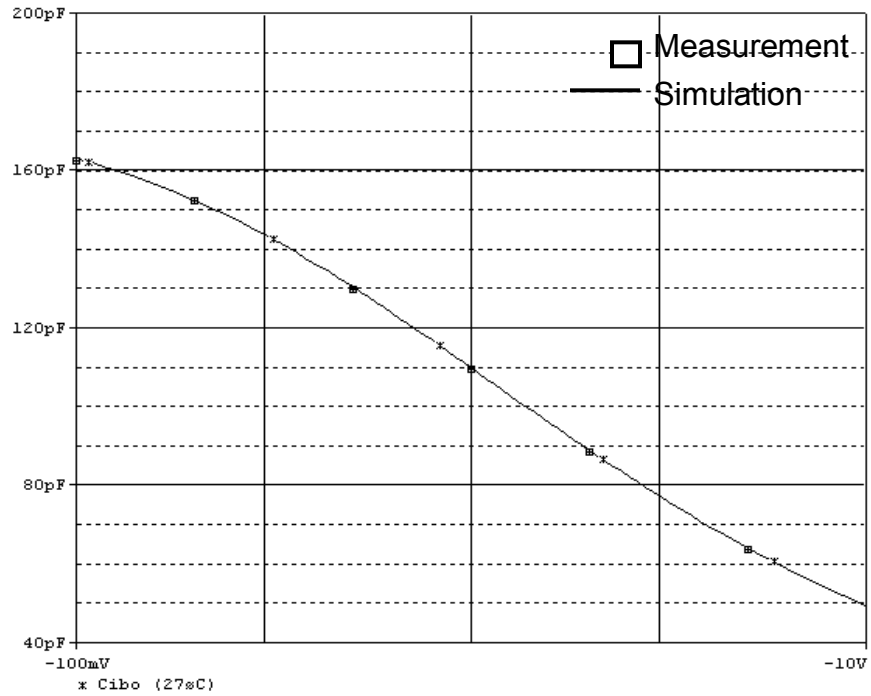
### Forward Early Voltage Characteristic



## C-B Capacitance Characteristics

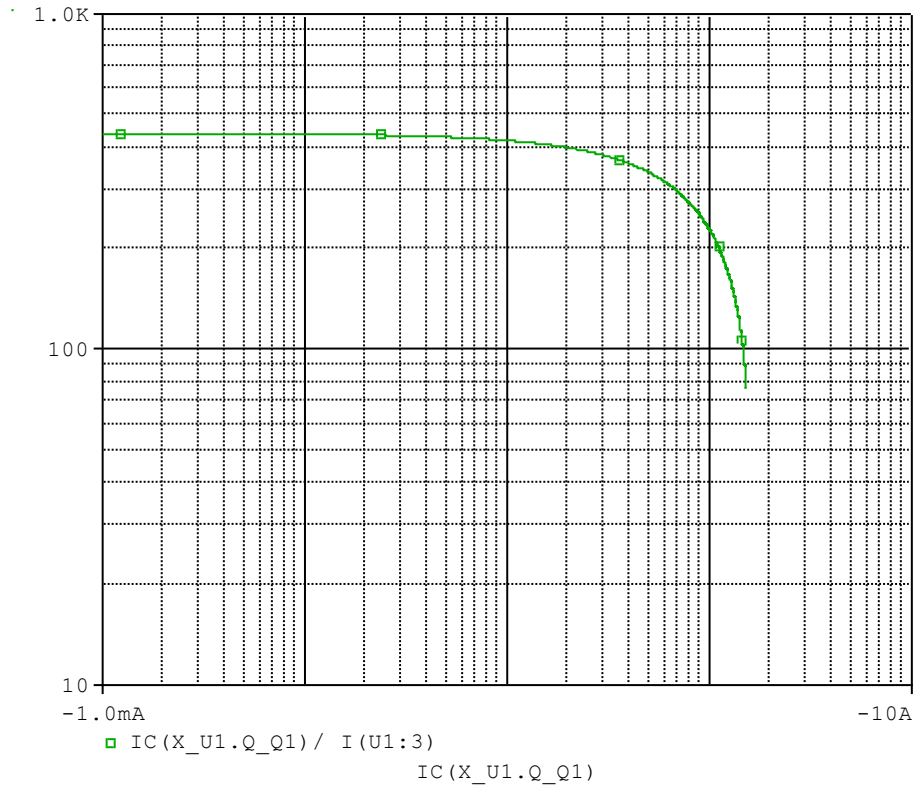


## E-B Capacitance Characteristics

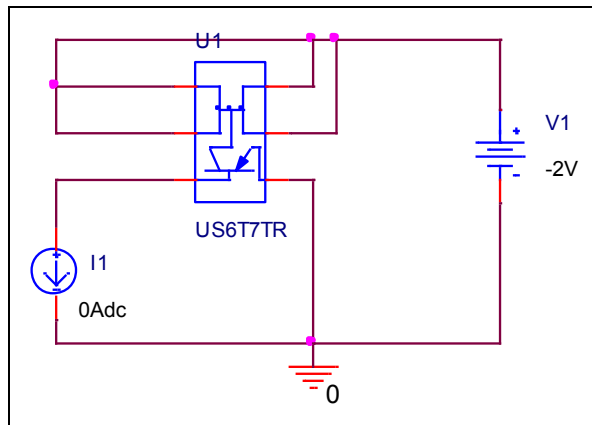


# Transistor $h_{FE}$ - $I_C$ Characteristics

## Circuit Simulation Result

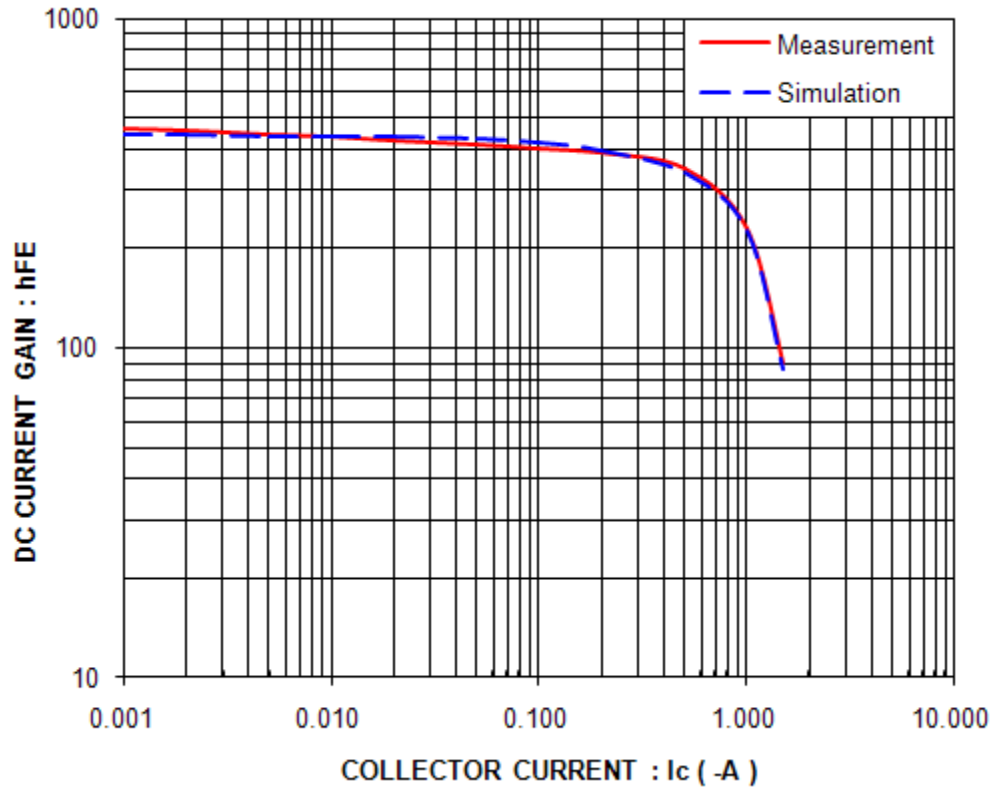


## Evaluation Circuit



## Comparison Graph

### Circuit Simulation Result



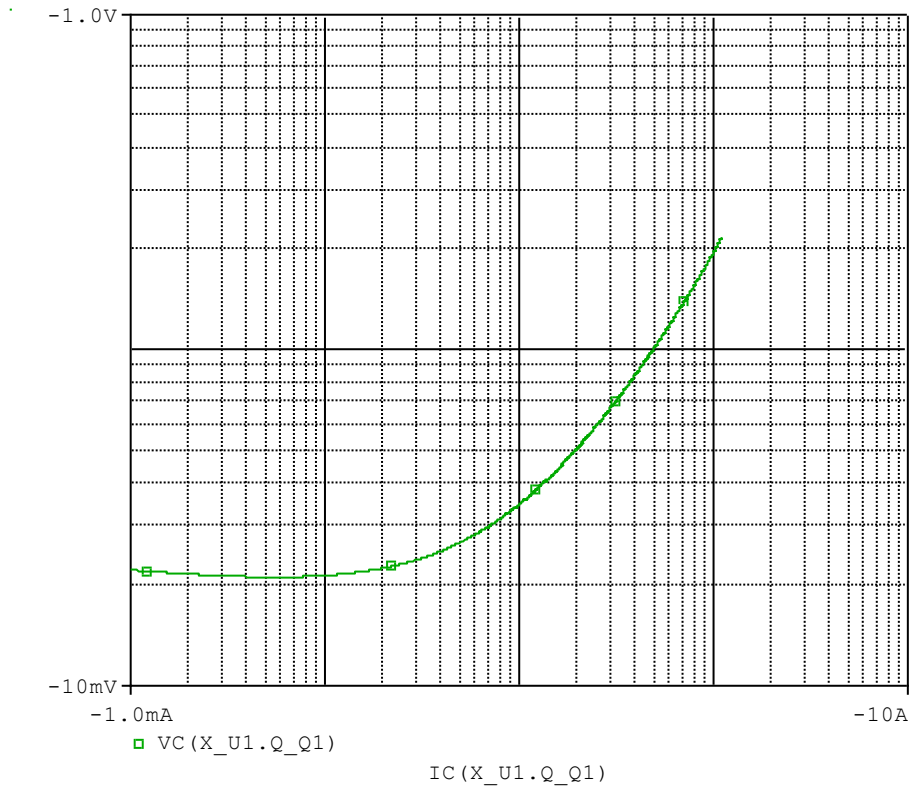
### Simulation Result

Ic(A)	hFE		Error(%)
	Measurement	Simulation	
-0.001	460.000	440.929	-4.146
-0.002	455.000	440.871	-3.105
-0.005	445.000	440.110	-1.099
-0.010	435.000	438.825	0.879
-0.020	425.000	436.466	2.698
-0.050	415.000	429.970	3.607
-0.100	405.000	419.646	3.616
-0.200	390.000	399.343	2.396
-0.500	350.000	337.747	-3.501
-1.000	230.000	227.783	-0.964
-1.500	90.000	85.726	-4.749

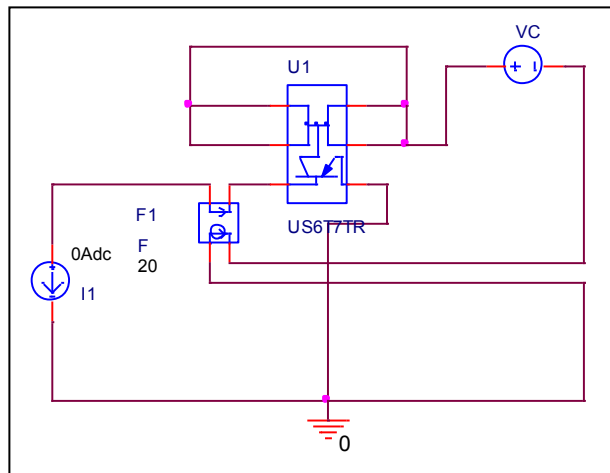


# $V_{CE(Sat)}$ - $I_C$ Characteristics

## Circuit Simulation Result

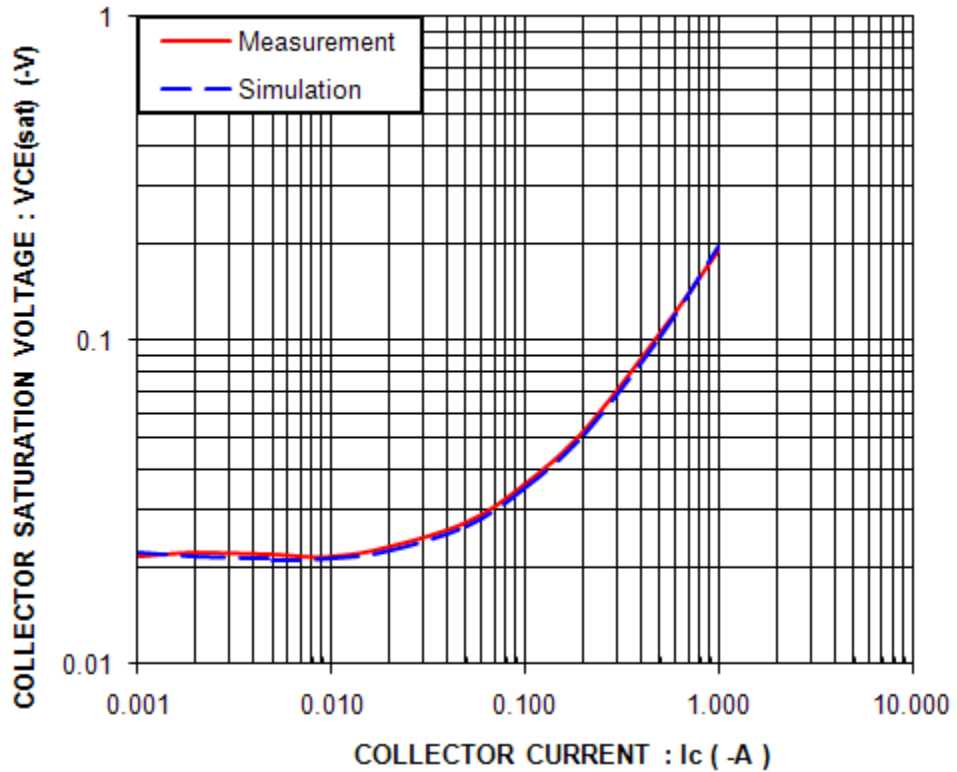


## Evaluation Circuit



## Comparison Graph

Circuit Simulation Result

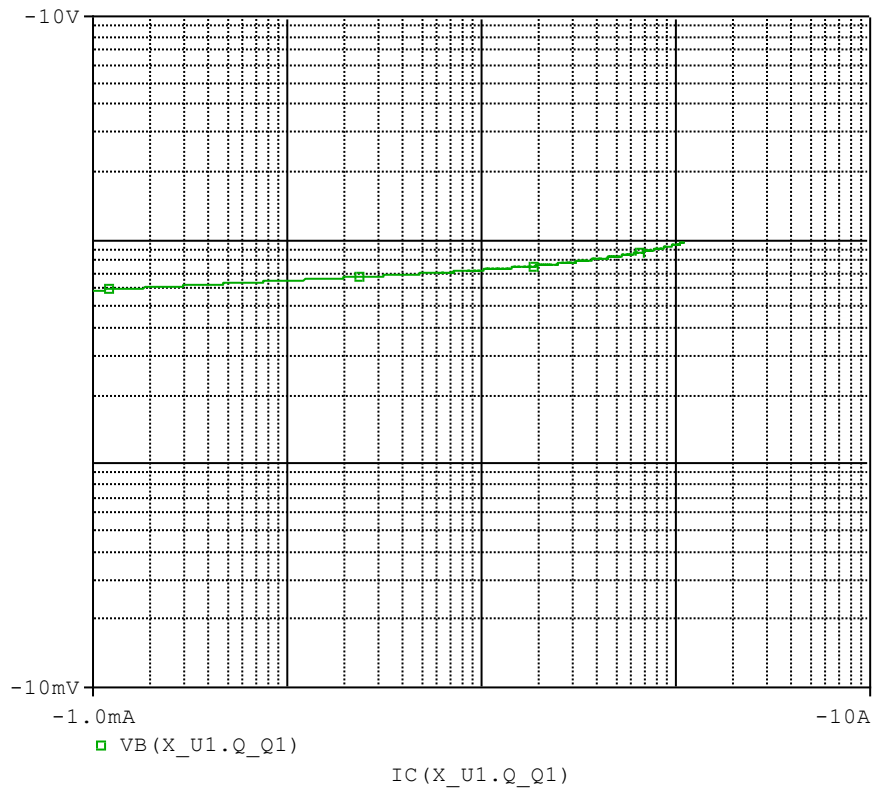


Simulation Result

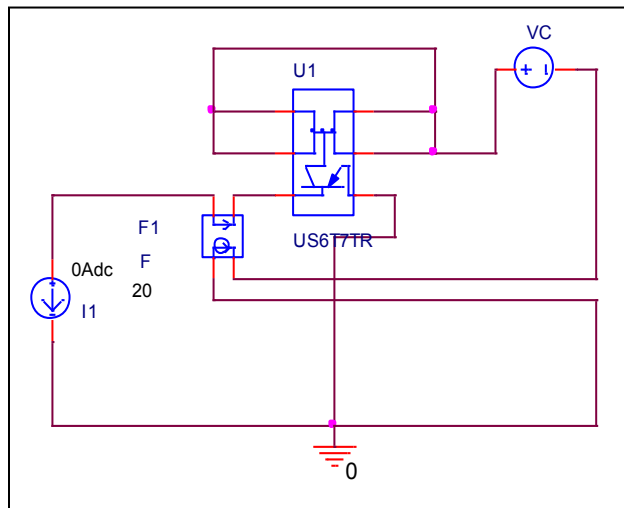
IC(A)	VCE(sat)(V)		Error(%)
	Measurement	Simulation	
-0.001	-0.0215	-0.0221	2.9721
-0.002	-0.0220	-0.0215	-2.1682
-0.005	-0.0218	-0.0211	-3.2156
-0.010	-0.0215	-0.0213	-0.8791
-0.020	-0.0230	-0.0224	-2.5304
-0.050	-0.0275	-0.0268	-2.6218
-0.100	-0.0360	-0.0347	-3.4806
-0.200	-0.0530	-0.0512	-3.3038
-0.500	-0.1050	-0.1026	-2.3152
-1.000	-0.1900	-0.1954	2.8379

# $V_{BE(Sat)}-I_C$ Characteristics

## Circuit Simulation Result

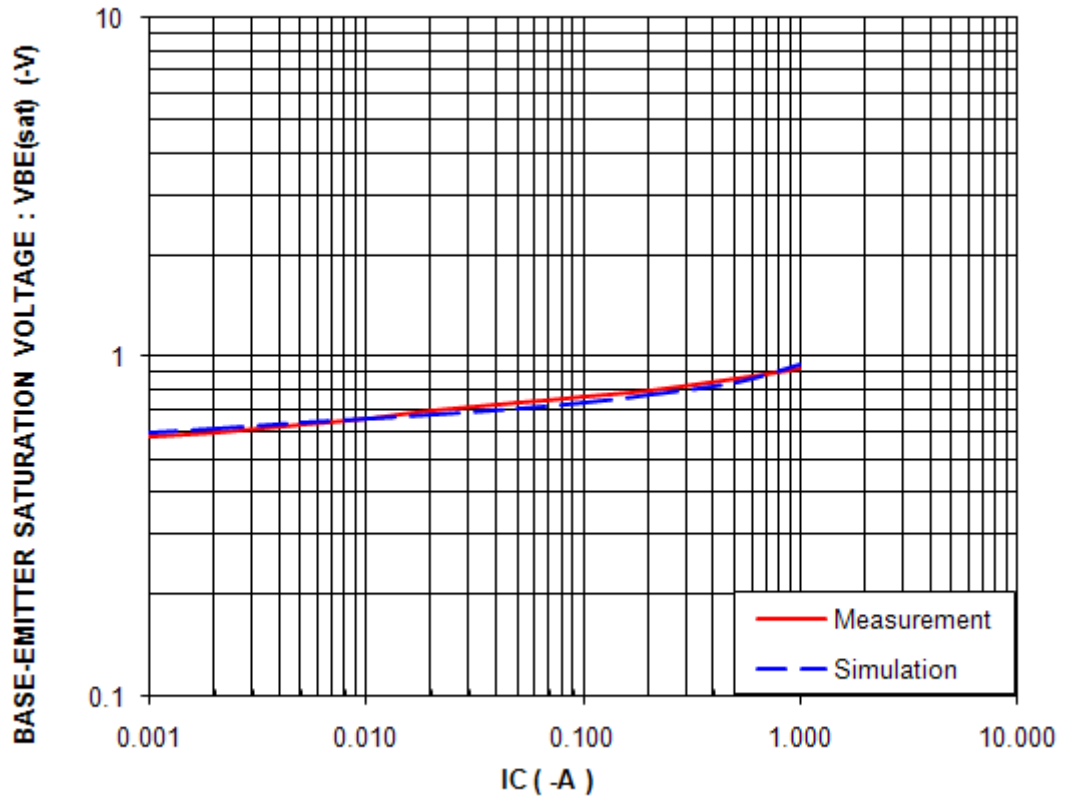


## Evaluation Circuit



## Comparison Graph

Circuit Simulation Result

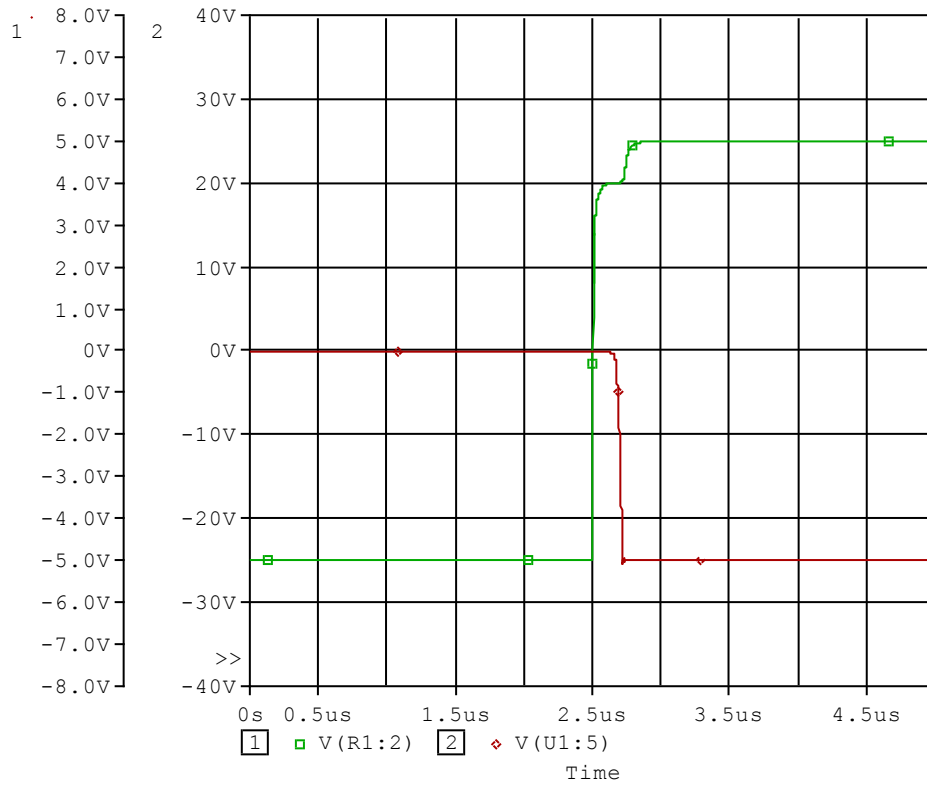


Simulation Result

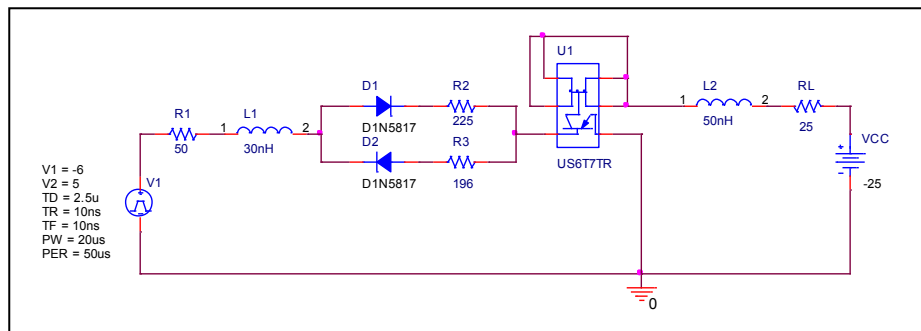
IC(A)	VBE(sat)(V)		Error(%)
	Measurement	Simulation	
-0.001	-0.580	-0.596	2.678
-0.002	-0.600	-0.614	2.375
-0.005	-0.630	-0.639	1.475
-0.010	-0.660	-0.659	-0.212
-0.020	-0.695	-0.679	-2.336
-0.050	-0.730	-0.708	-2.987
-0.100	-0.760	-0.735	-3.280
-0.200	-0.800	-0.770	-3.702
-0.500	-0.860	-0.846	-1.608
-1.000	-0.920	-0.953	3.618

# Switching Characteristics

## Circuit simulation result



## Evaluation circuit

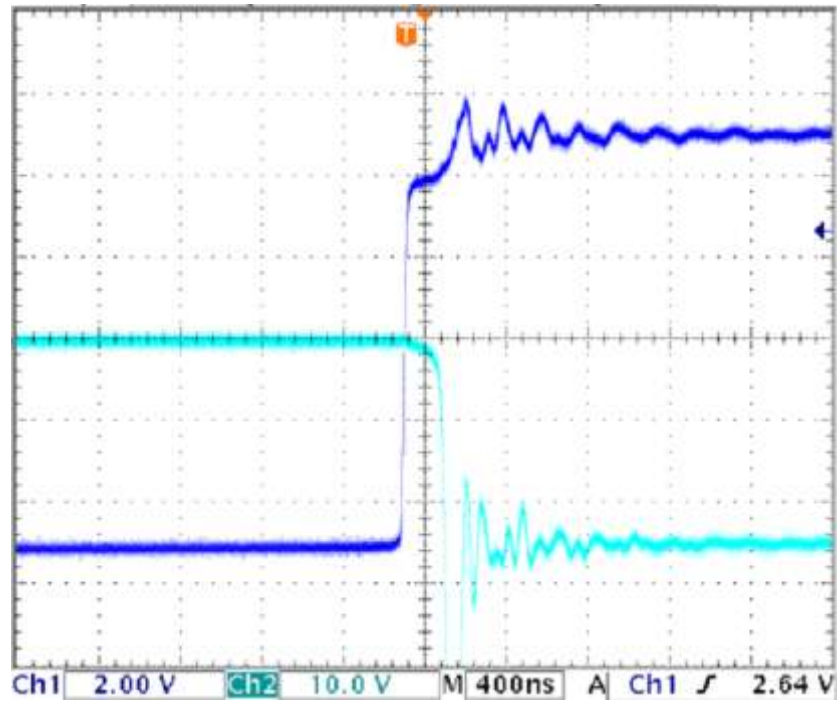


## Simulation result

	Measurement	Simulation	%Error
<b>t<sub>f</sub> (ns)</b>	<b>42.000</b>	<b>41.154</b>	<b>-2.014</b>
<b>t<sub>stg</sub> (ns)</b>	<b>176.000</b>	<b>176.141</b>	<b>0.080</b>

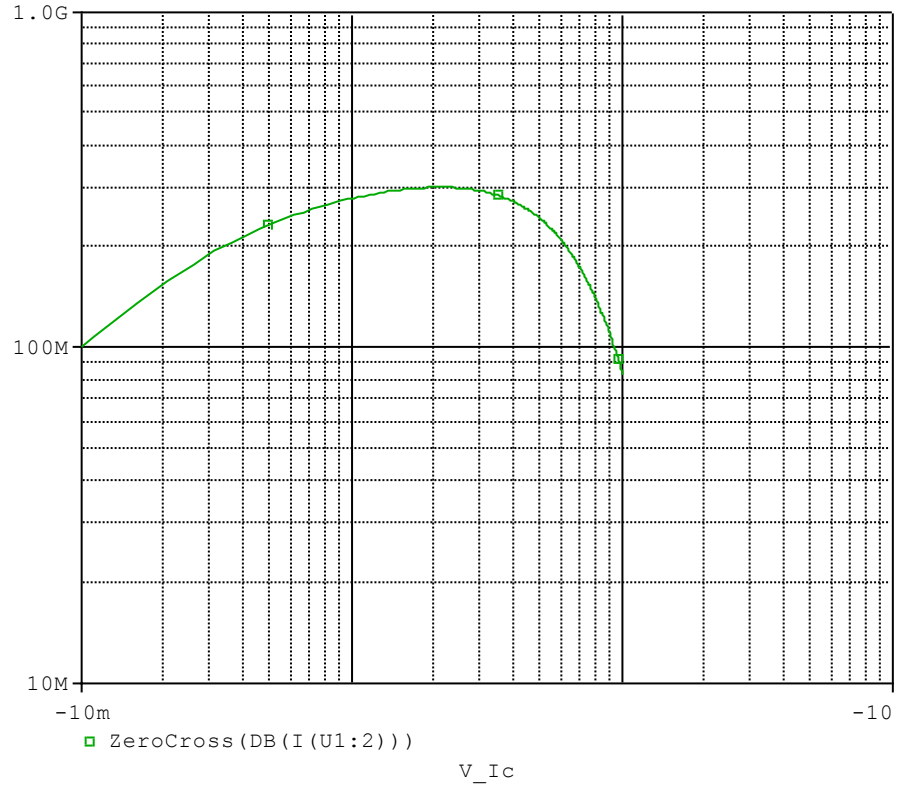
# Switching Characteristics

# Reference

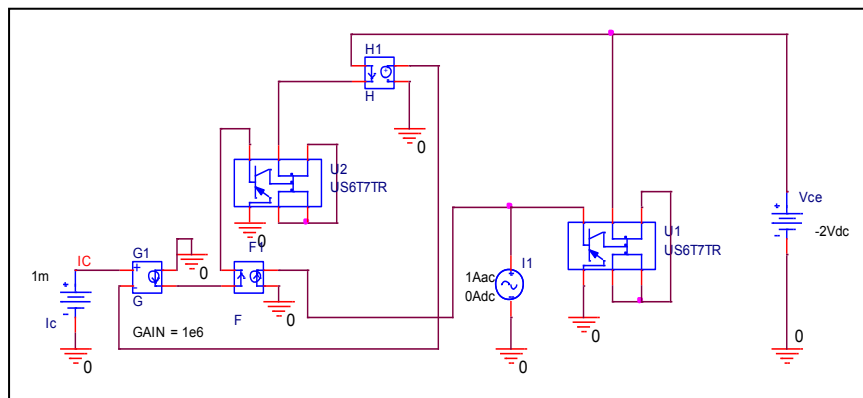


# $F_t$ - $I_C$ Characteristics

## Circuit Simulation Result

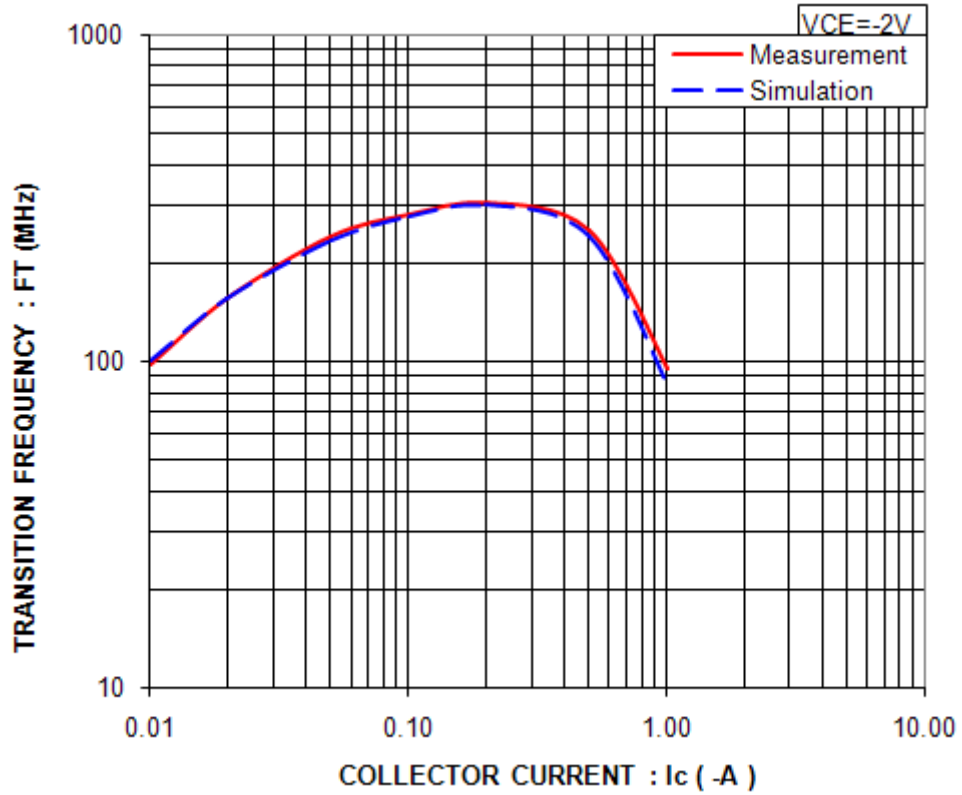


## Evaluation Circuit



## Comparison Graph

Circuit Simulation Result



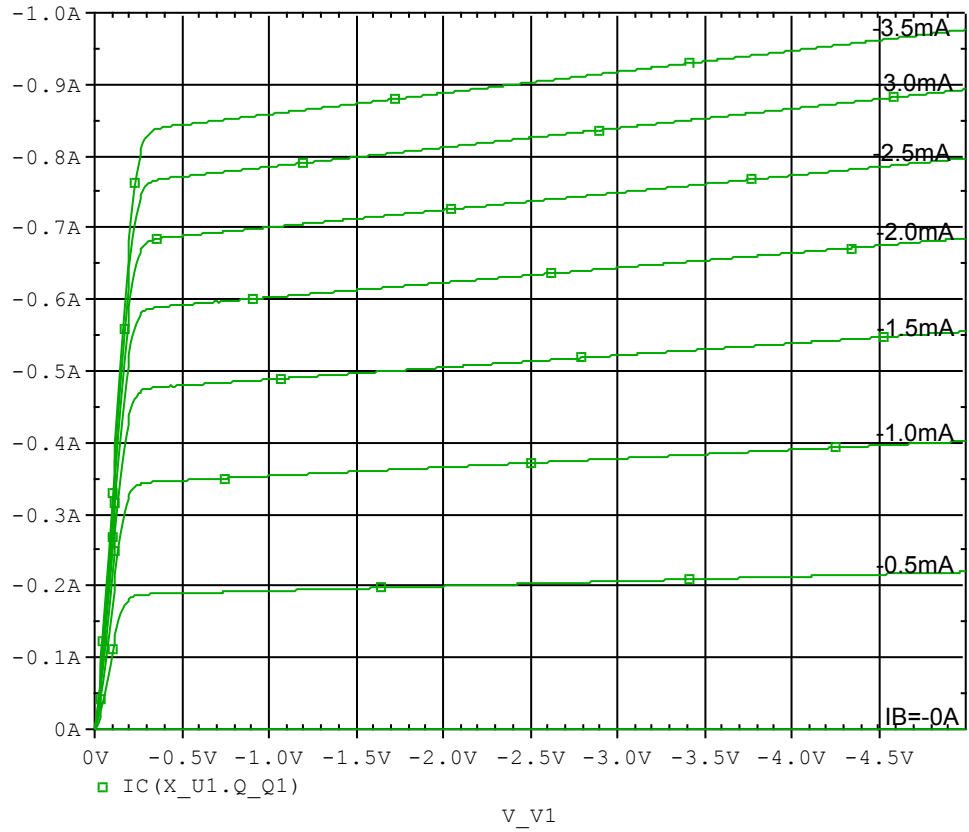
Simulation Result

-Ic(A)	FT(MHz)		Error(%)
	Measurement	Simulation	
0.010	97.000	99.866	2.955
0.020	155.000	154.858	-0.092
0.050	240.000	232.954	-2.936
0.100	280.000	278.980	-0.364
0.200	305.000	300.867	-1.355
0.500	250.000	241.563	-3.375

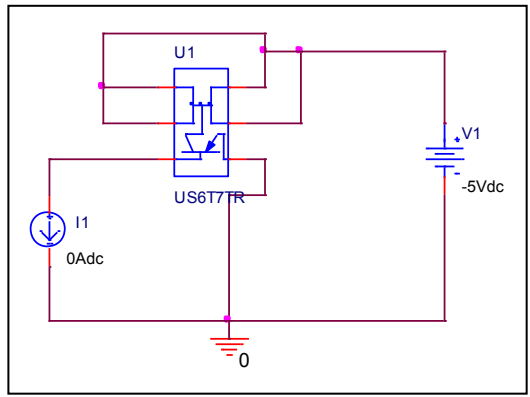


# Output Characteristics

Circuit Simulation Result



Evaluation Circuit



# Output Characteristics

# Reference

