

RoHS Compliant Product  
A suffix of "-C" specifies halogen & lead-free

**FEATURES**

- Simplifies Circuit Design.
- We Declare that the material of product compliance with RoHS requirements.

**MARKING**

2A

3N

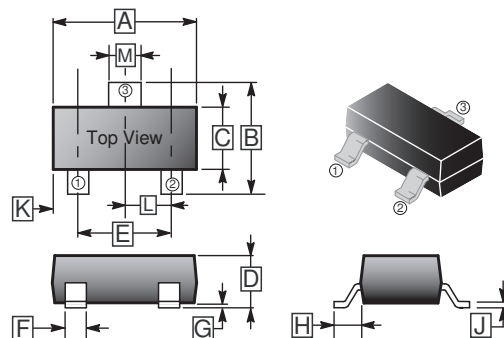
**PACKAGE INFORMATION**

Package	MPQ	Leader Size
SOT-523	3K	7 inch

**ORDER INFORMATION**

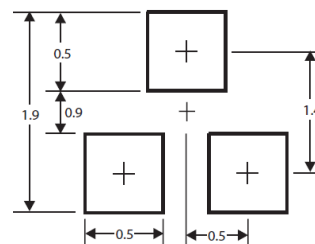
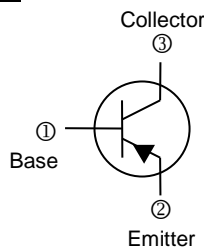
Part Number	Type
MMBT3906FW-C	Lead (Pb)-free and Halogen-free

**SOT-523**



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.50	1.70	G	-	0.10
B	1.45	1.75	H	0.55 REF.	
C	0.70	0.90	J	0.08	0.20
D	0.60	0.90	K	-	
E	0.90	1.10	L	0.50 TYP.	
F	0.15	0.35	M	0.25	0.40

**Mounting Pad Layout**



\*Dimensions in millimeters

**MAXIMUM RATINGS** (T<sub>A</sub>=25°C unless otherwise specified)

Parameter	Symbol	Ratings	Unit	
Collector-Base Voltage	V <sub>CB0</sub>	-40	V	
Collector-Emitter Voltage	V <sub>CEO</sub>	-40		
Emitter-Base Voltage	V <sub>EB0</sub>	-5		
Continuous Collector Current	I <sub>c</sub>	-200	mA	
Total Device Dissipation FR-4 Board <sup>1</sup>	P <sub>D</sub>	T <sub>A</sub> =25°C	200	mW
		Derate above 25°C	1.6	mW/°C
Thermal Resistance, Junction-Ambient	R <sub>θJA</sub>	600	°C/W	
Total Device Dissipation FR-4 Board <sup>2</sup>	P <sub>D</sub>	T <sub>A</sub> =25°C	300	mW
		Derate above 25°C	2.4	mW/°C
Thermal Resistance, Junction-Ambient	R <sub>θJA</sub>	400	°C/W	
Junction & Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55~150	°C	

Notes:

1. FR-4 Minimum Pad.
2. FR-4 1.0 X 1.0 Inch Pad.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

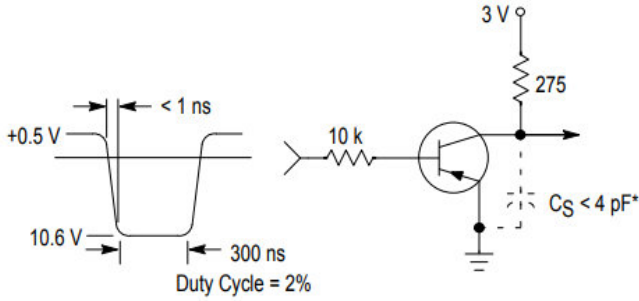
**ELECTRICAL CHARACTERISTICS** ( $T_A=25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Min.	Max.	Unit	Test conditions
Collector-Emitter Breakdown Voltage <sup>1</sup>	$V_{(BR)CEO}$	-40	-	V	$I_C = -1\text{mA}, I_B = 0$
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-40	-	V	$I_C = -10\mu\text{A}, I_E = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-5.0	-	V	$I_E = -10\mu\text{A}, I_C = 0$
Collector Cut-Off Current	$I_{BL}$	-	-50	nA	$V_{CE} = -30\text{V}, V_{EB} = -3\text{V}$
Emitter Cut-Off Current	$I_{CEX}$	-	-50	nA	$V_{CE} = -30\text{V}, V_{EB} = -3\text{V}$
DC Current Gain <sup>1</sup>	$h_{FE}$	60	-		$I_C = -0.1\text{mA}, V_{CE} = -1\text{V}$
		80	-		$I_C = -1\text{mA}, V_{CE} = -1\text{V}$
		100	300		$I_C = -10\text{mA}, V_{CE} = -1\text{V}$
		60	-		$I_C = -50\text{mA}, V_{CE} = -1\text{V}$
		30	-		$I_C = -100\text{mA}, V_{CE} = -1\text{V}$
Collector-Emitter Saturation Voltage <sup>1</sup>	$V_{CE(sat)}$	-	-0.25	V	$I_C = -10\text{mA}, I_B = -1\text{mA}$
		-	-0.4		$I_C = -50\text{mA}, I_B = -5\text{mA}$
Base-Emitter Saturation Voltage <sup>1</sup>	$V_{BE(sat)}$	-0.65	-0.85	V	$I_C = -10\text{mA}, I_B = -1\text{mA}$
		-	-0.95		$I_C = -50\text{mA}, I_B = -5\text{mA}$
Current-Gain-Bandwidth Product	$f_T$	250	-	MHz	$V_{CE} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$
Output Capacitance	$C_{obo}$	-	4.5	pF	$V_{CB} = -5\text{V}, I_E = 0, f = 1\text{MHz}$
Input Capacitance	$C_{ibo}$	-	10	pF	$V_{EB} = -0.5\text{V}, I_E = 0, f = 1\text{MHz}$
Input Impedance	$h_{ie}$	2.0	12	pF	$V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$
Voltage Feedback Ratio	$h_{re}$	0.1	10	$\times 10^{-4}$	$V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$
Small-Signal Current Gain	$h_{fe}$	100	400		$V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$
Output Admittance	$*h_{oe}$	3.0	60	$\mu\text{mhos}$	$V_{CE} = -10\text{V}, I_C = -1\text{mA}, f = 1\text{kHz}$
Noise Figure	NF	-	4.0	dB	$V_{CE} = -5\text{V}, I_C = -100\mu\text{A}, R_S = 1\text{k}\Omega, f = 1\text{kHz}$
Delay Time	$T_d$	-	35	nS	$V_{CC} = -3\text{V}, V_{BE} = -0.5\text{V}, I_C = -10\text{mA}, I_{B1} = -1\text{mA}$
Rise Time	$T_r$	-	35		
Storage Time	$T_s$	-	225	nS	$V_{CC} = -3\text{V}, I_C = -10\text{mA}, I_{B1} = I_{B2} = -1\text{mA}$
Fall Time	$T_f$	-	75		

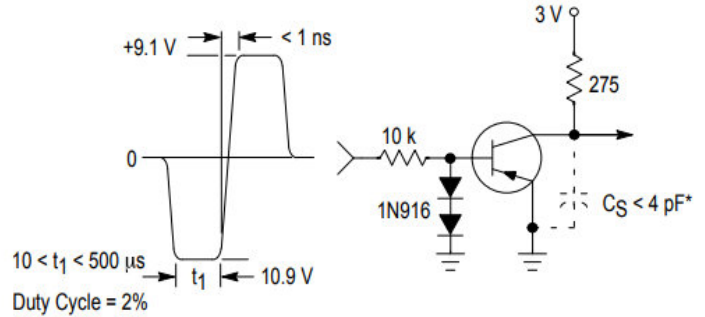
Note:

1. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

**CHARACTERISTIC CURVES**

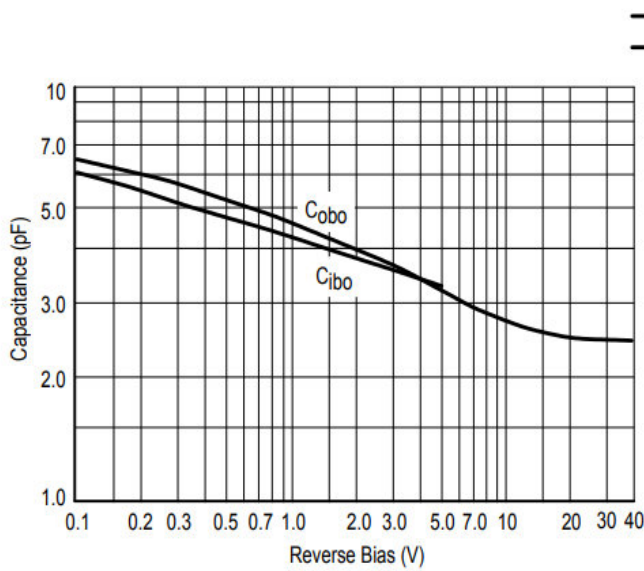


**Figure 1. Delay and Rise Time Equivalent Test Circuit**

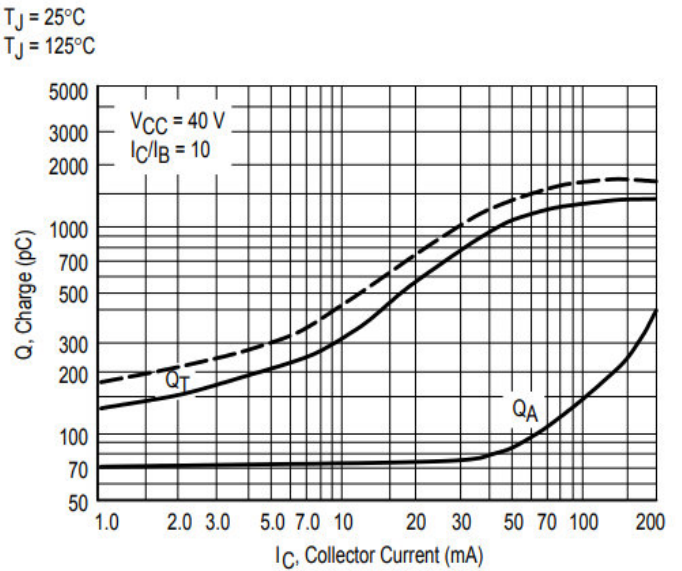


**Figure 2. Storage and Fall Time Equivalent Test Circuit**

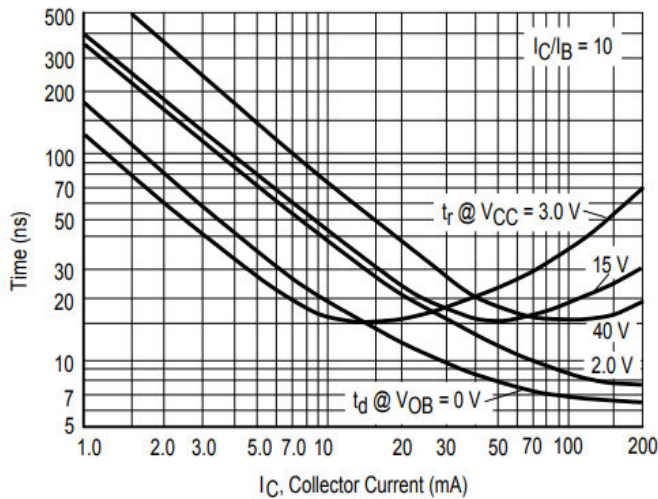
\* Total shunt capacitance of test jig and connectors



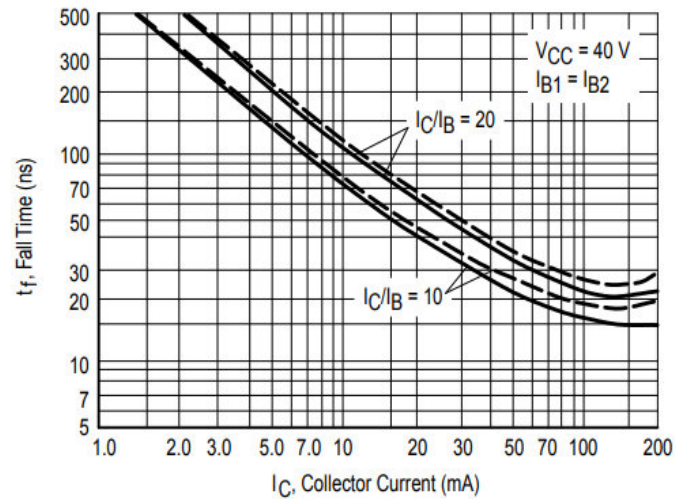
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**

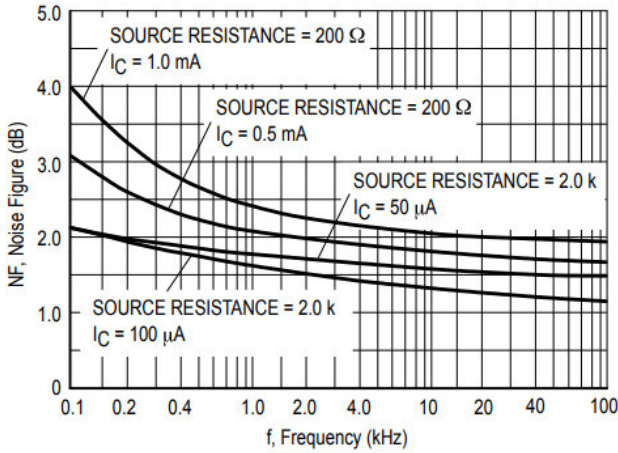


**Figure 6. Fall Time**

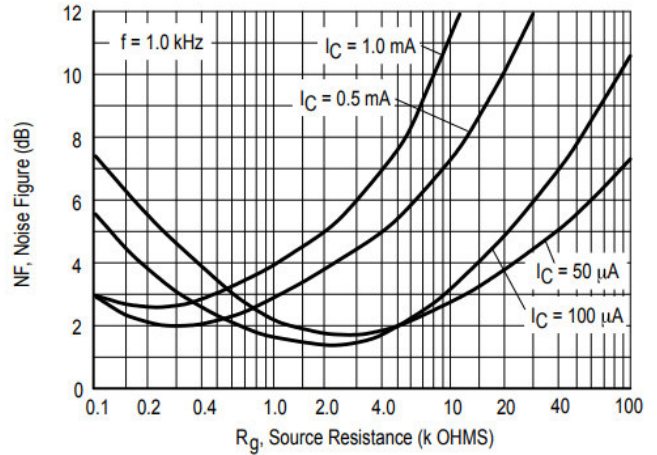
**CHARACTERISTIC CURVES**

**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS**  
**NOISE FIGURE VARIATIONS**

( $V_{CE} = -5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ , Bandwidth = 1.0 Hz)



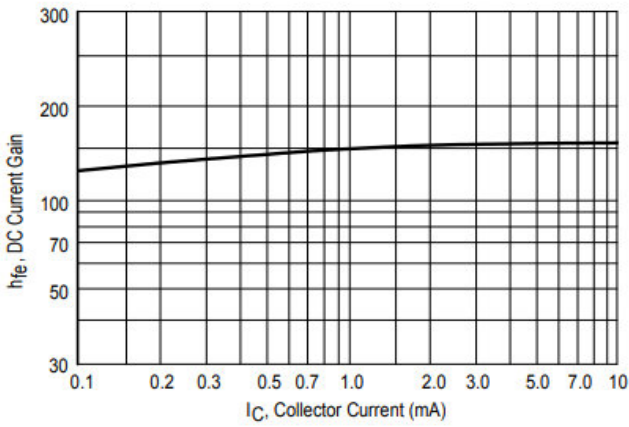
**Figure 7.**



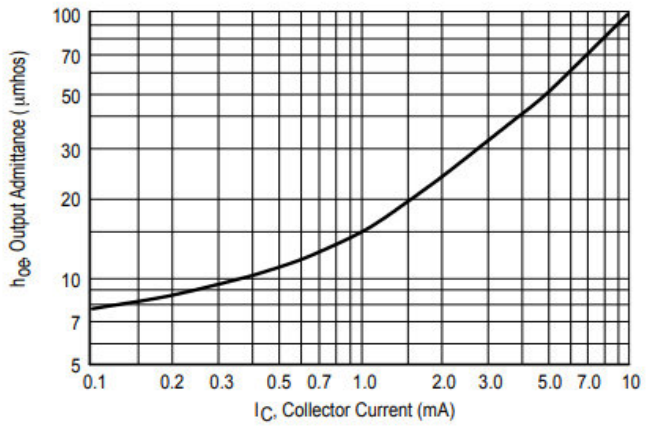
**Figure 8.**

**h PARAMETERS**

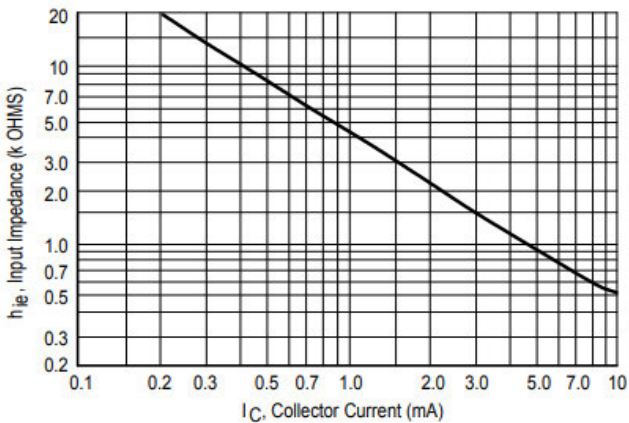
( $V_{CE} = -10 \text{ Vdc}$ ,  $f = 1.0 \text{ kHz}$ ,  $T_A = 25^\circ\text{C}$ )



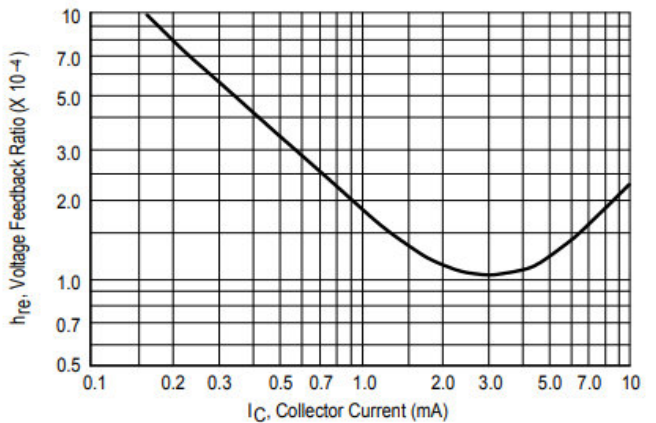
**Figure 9. Current Gain**



**Figure 10. Output Admittance**



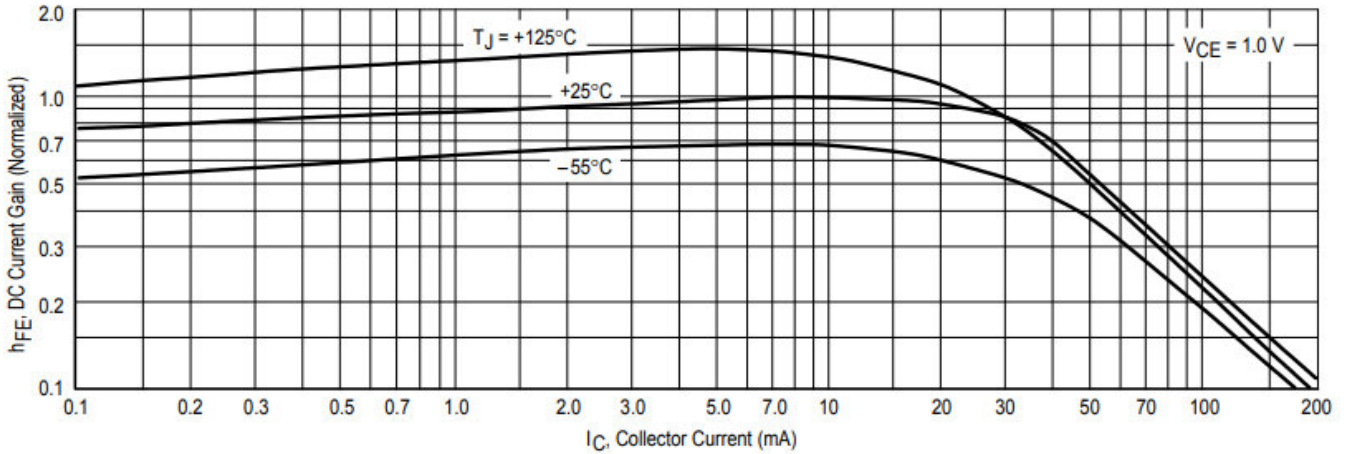
**Figure 11. Input Impedance**



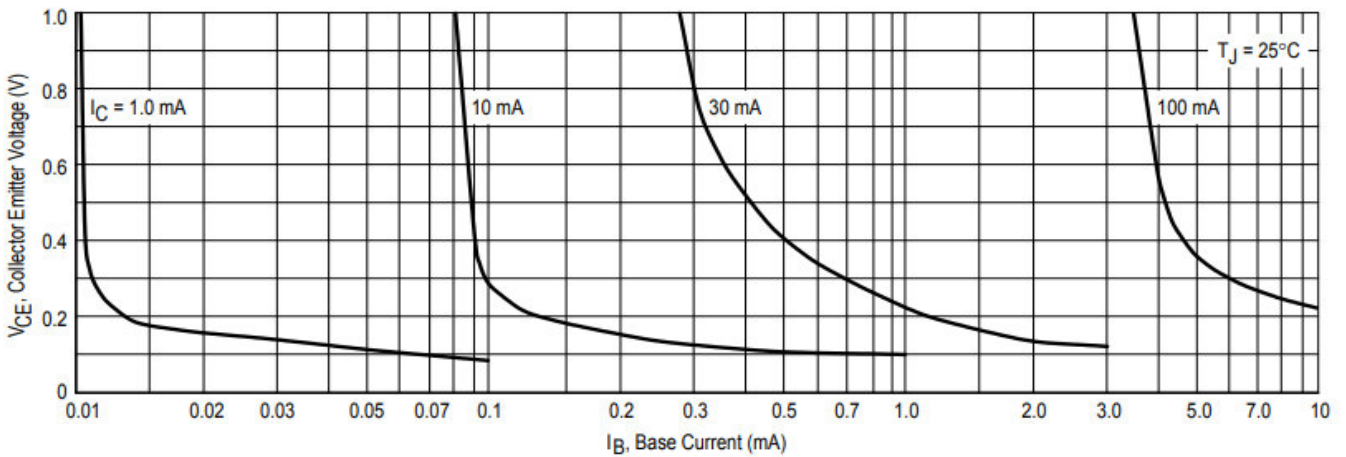
**Figure 12. Voltage Feedback Ratio**

**CHARACTERISTIC CURVES**

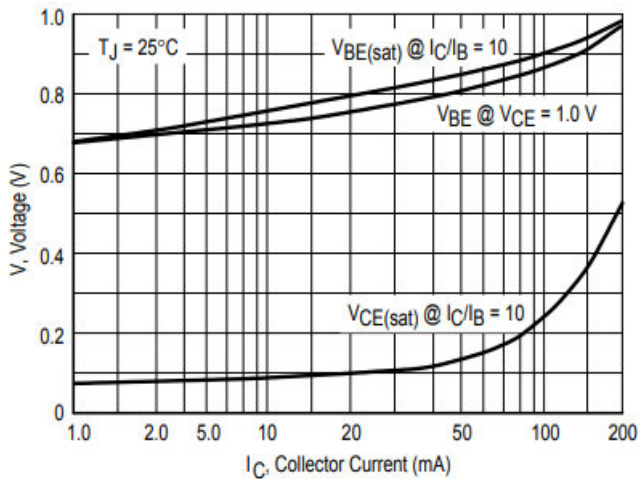
**TYPICAL STATIC CHARACTERISTICS**



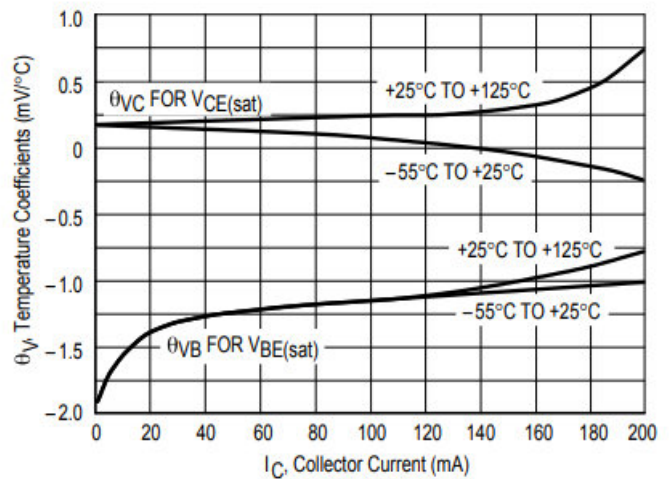
**Figure 13. DC Current Gain**



**Figure 14. Collector Saturation Region**



**Figure 15. "ON" Voltages**



**Figure 16. Temperature Coefficients**