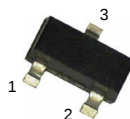


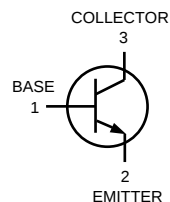
General Purpose Transistor

NPN Silicon

MMBT3904



SOT-23



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	40	V _{dc}
Collector-Base Voltage	V _{CBO}	60	V _{dc}
Emitter-Base Voltage	V _{EBO}	6.0	V _{dc}
Collector Current-Continuous	I _C	200	mA _{dc}

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Total Device Dissipation FR-5 Board ⁽¹⁾ T _A =25°C Derate above 25°C	P _D	225 1.8	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	556	°C / W
Total Device Dissipation Alumina Substrate, ⁽²⁾ T _A =25°C Derate above 25°C	P _D	300 2.4	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	417	°C / W
Junction and Storage Temperature	T _J , T _{STG}	-55 to +150	°C

DEVICE MARKING

MMBT3904=1AM

ELECTRICAL CHARACTERISTICS (T_A=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Max.	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdowe Voltage ⁽³⁾ (I _C =1.0mA _{dc} , I _B =0)	V _{(BR)CEO}	40	-	V _{dc}
Collector-Base Breakdowe Voltage (I _C =10 μA _{dc} , I _E =0)	V _{(BR)CBO}	60	-	V _{dc}
Emitter-Base Breakdowe Voltage (I _E =10 μA _{dc} , I _C =0)	V _{(BR)EBO}	6.0	-	V _{dc}
Base Cutoff Current (V _{CE} =30 V _{dc} , V _{EB} =3.0 V _{dc})	I _{BL}	-	50	nA _{dc}
Collector Cutoff Current (V _{CE} =30 V _{dc} , V _{EB} =3.0 V _{dc})	I _{CEX}	-	50	nA _{dc}

ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min.	Max.	Unit
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ON CHARACTERISTICS⁽³⁾

DC Current Gain (IC=0.1 mAdc, VCE=1.0 Vdc) (IC=1.0 mAdc, VCE=1.0 Vdc) (IC=10 mAdc, VCE=1.0 Vdc) (IC=50 mAdc, VCE=1.0 Vdc) (IC=100 mAdc, VCE=1.0 Vdc)	HFE	40 70 100 60 30	- - 300 - -	-
Collector-Emitter Saturation Voltage ⁽³⁾ (IC=10 mAdc, IB=1.0 mAdc) (IC=50 mAdc, IB=5.0 mAdc)	VCE(sat)	- -	0.2 0.3	Vdc
Base-Emitter Saturation Voltage ⁽³⁾ (IC=10 mAdc, IB=1.0 mAdc) (IC=50 mAdc, IB=5.0 mAdc)	VBE(sat)	0.65 -	0.85 0.95	Vdc

SMALL-SIGNAL CHARACTERISTIC

Current-Gain-Bandwidth Product (IC=10 mAdc, VCE=20 Vdc, f=100 MHz)	fT	300	-	MHz
Output Capacitance (VCB=5.0 Vdc, IE=0, f=1.0 MHz)	Cobo	-	4.0	pF
Input Capacitance (VEB=0.5 Vdc, IC=0, f=1.0 MHz)	Cibo	-	8.0	pF
Input Impedance (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hie	1.0	10	k ohms
Voltage Feedback Ratio (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hre	0.5	8.0	$\times 10^{-4}$
Small-Signal Current Gain (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hfe	100	400	-
Output Admittance (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hoe	1.0	40	u mhos
Noise Figure (VCE=5.0 Vdc, IC=100 uAdc, RS=1.0 k ohm, f=1.0 kHz)	NF	-	5.0	dB

SWITCHING CHARACTERISTICS

Delay Time	(VCC=3.0 Vdc, VBE=-0.5 Vdc, IC=10 mAdc, IB1=1.0 mAdc)	td	-	35	nS
Rise Time		tr	-	35	
Storage Time	(VCC=3.0 Vdc, IC=10 mAdc, IB1=IB2=1.0 mAdc)	ts	-	200	nS
Fall Time		tf	-	50	

(1) FR-5=1.0 × 0.75 × 0.062in.

(2) Alumina=0.4 × 0.3 × 0.024in. 99.5% alumina.

(3) Pulse Test : Pulse Width ≤ 300uS, Duty Cycle ≤ 2.0%.

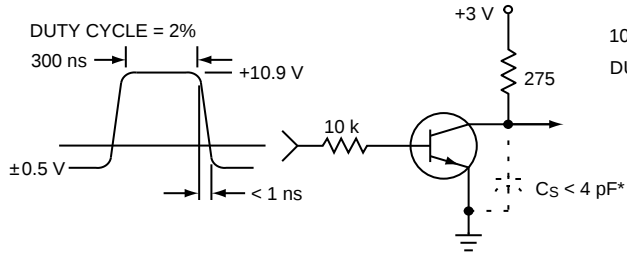


Figure 1. Delay and Rise Time
Equivalent Test Circuit

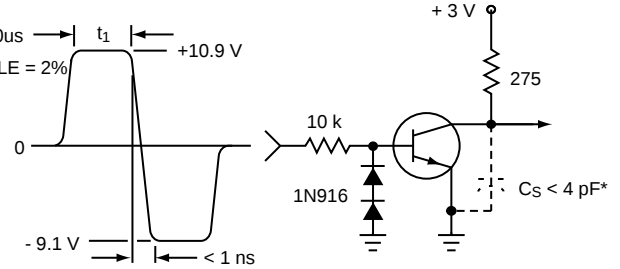


Figure 2. Storage and Fall Time
Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

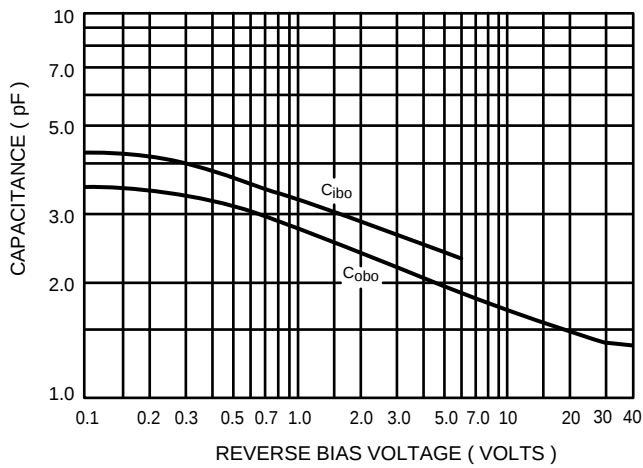


Figure 3. Capacitance

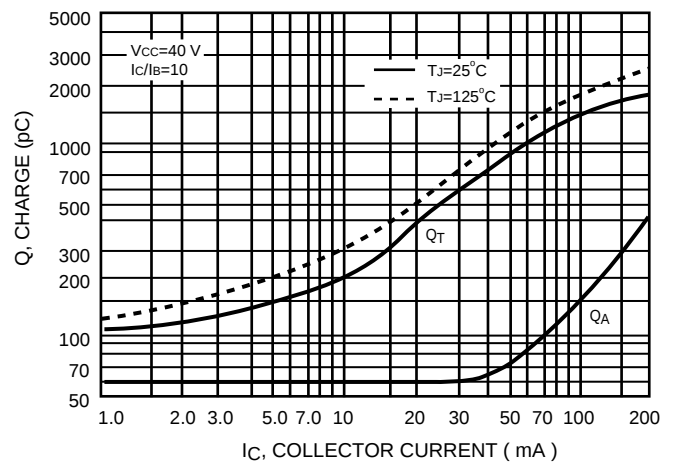


Figure 4. Charge Data

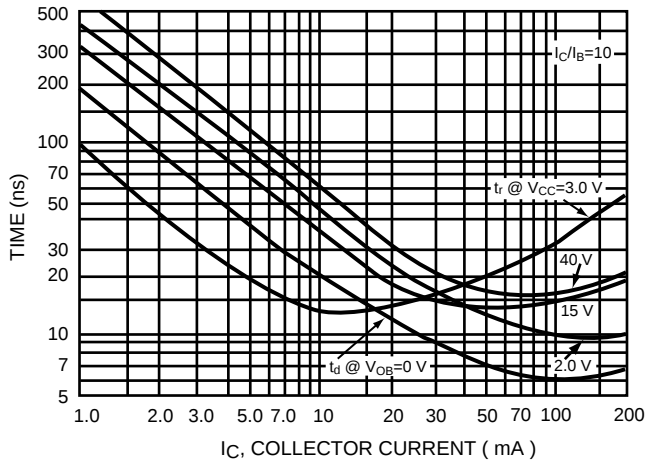


Figure 5. Turn-On Time

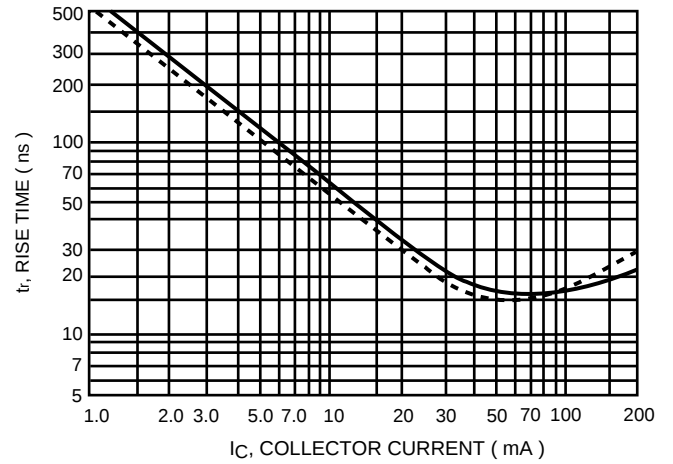


Figure 6. Rise Time

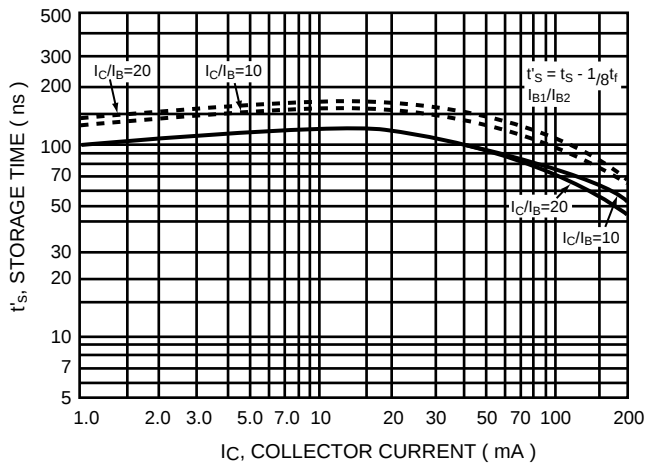


Figure 7. Storage Time

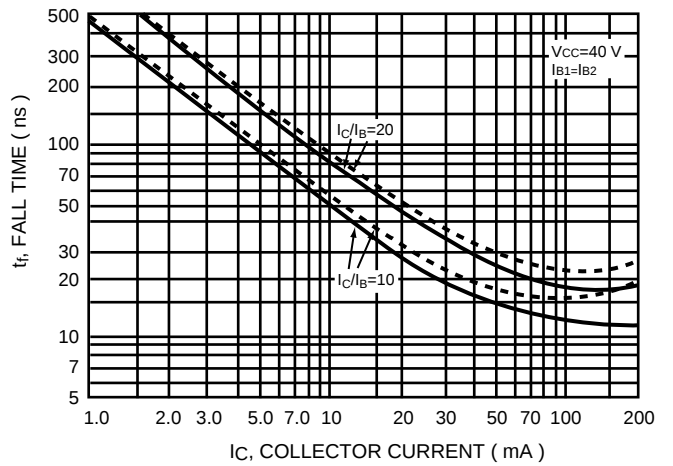


Figure 8. Fall Time

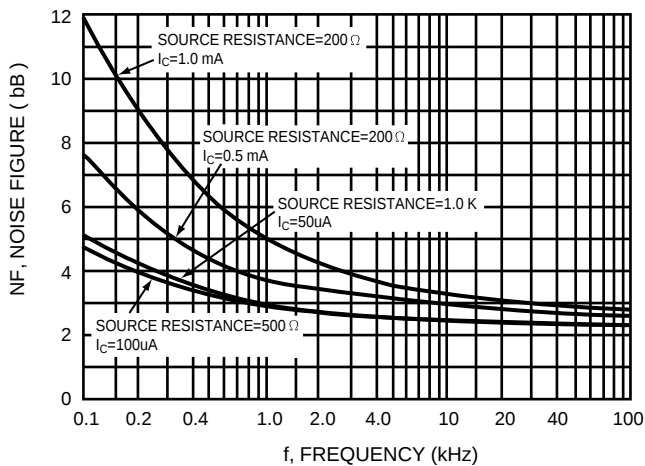


Figure 9.

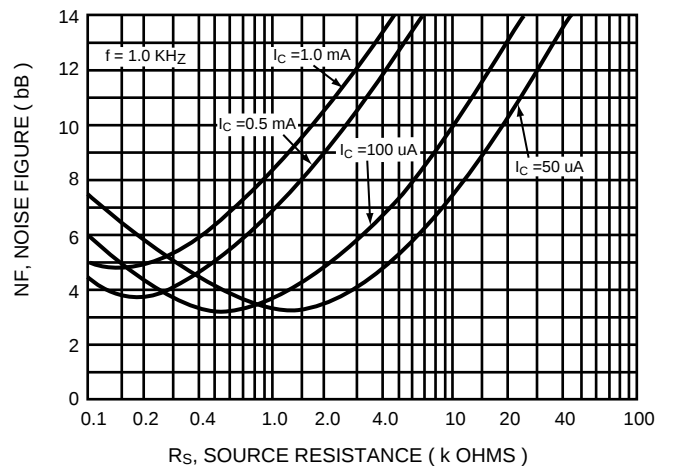


Figure 10.



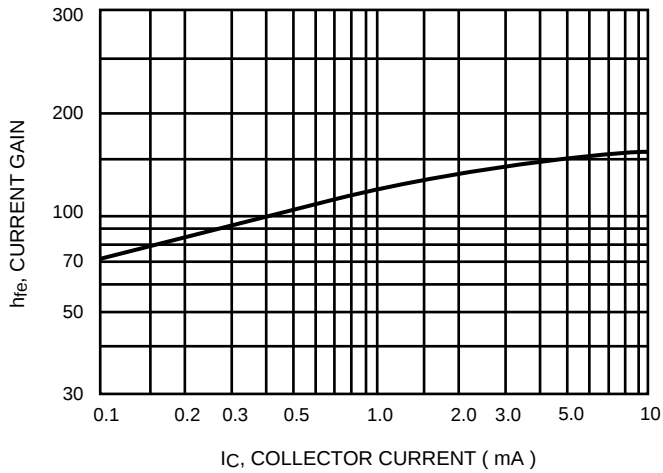


Figure 11. Current Gain

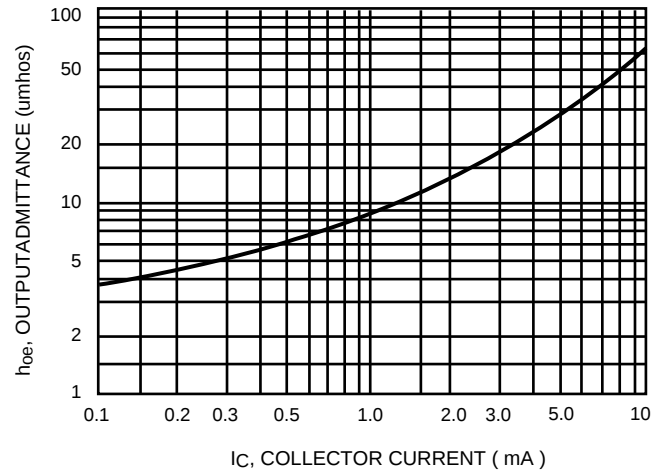


Figure 12. Output Admittance

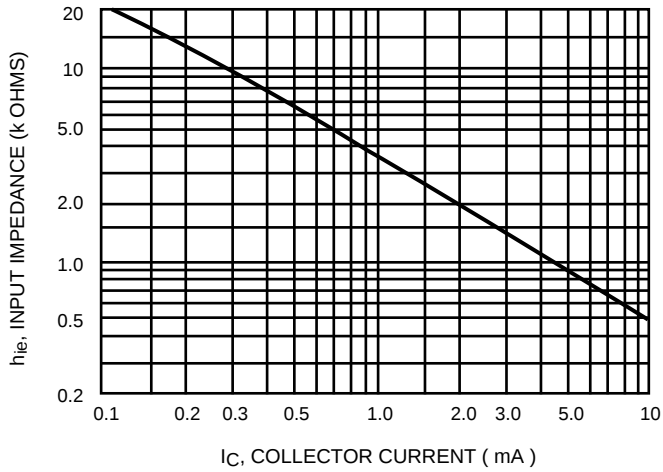


Figure 13. Input Impedance

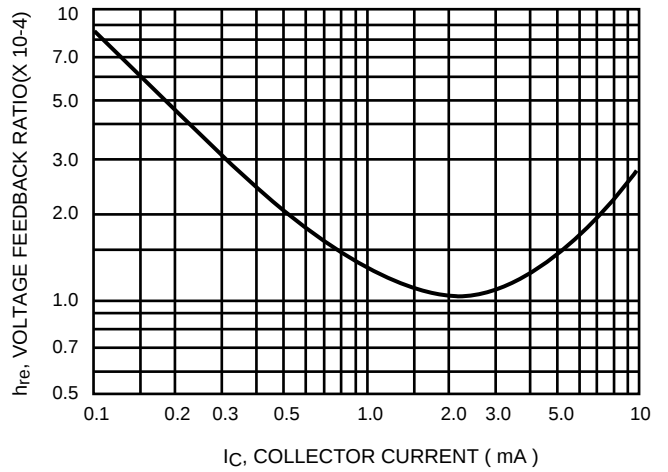


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

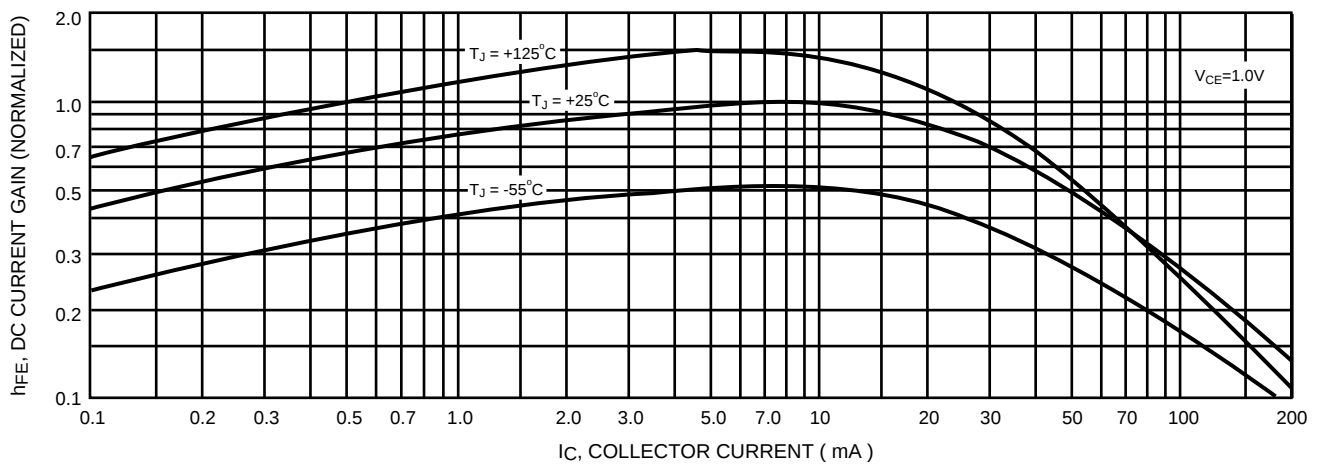


Figure 15. DC Current Gain



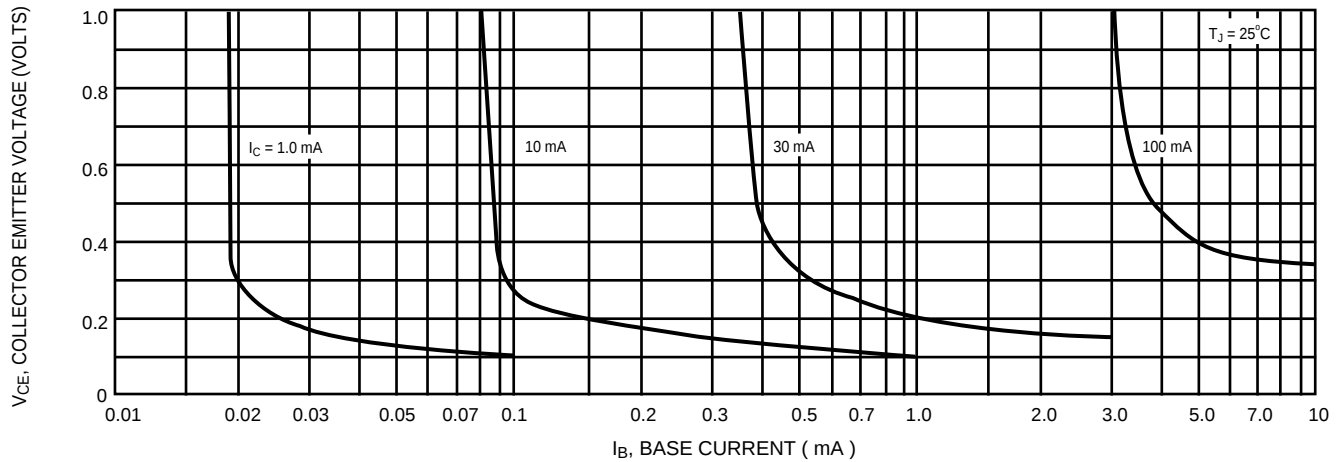


Figure 16. Collector Saturation Region

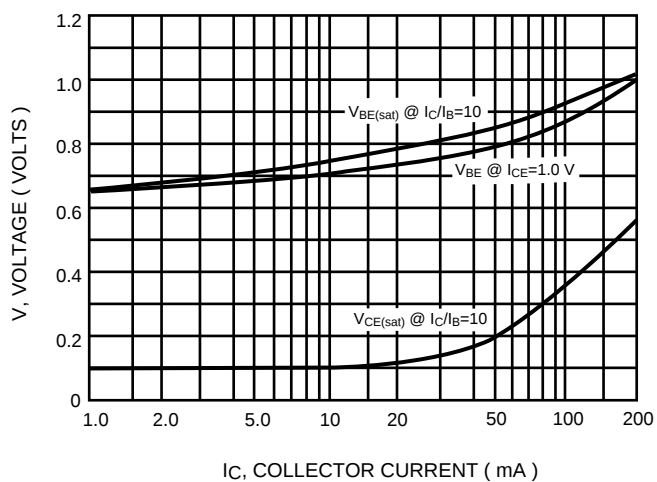


Figure 17. " ON " Voltage

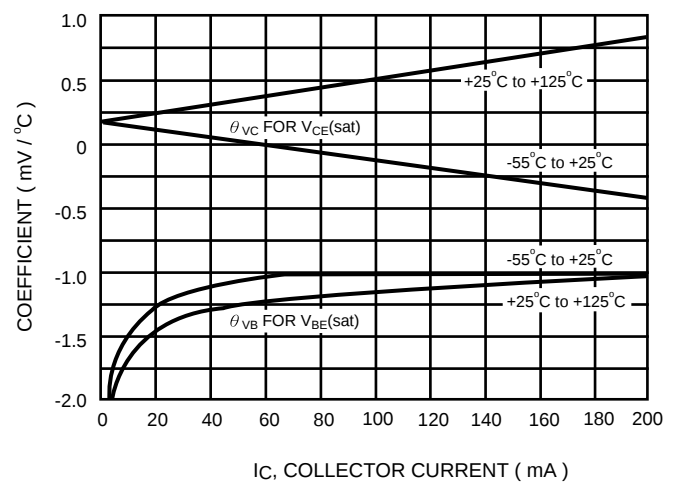


Figure 18. Temperature Coefficients