



MMBT3906

PNP GENERAL PURPOSE SWITCHING TRANSISTOR

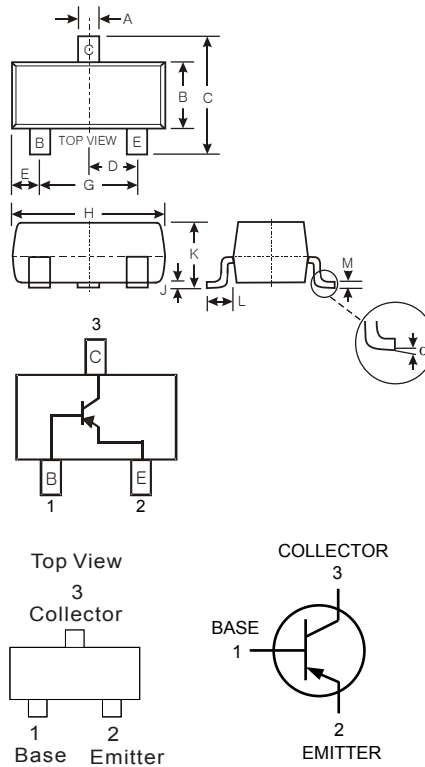
Voltage - -40 Volts Power Dissipation - 300 mWatt

FEATURES

- Epitaxial Planar Die Construction
- Complementary NPN Type Available (MMBT3904)
- Ideal for Medium Power Amplification and Switching

MECHANICAL DATA

- Case: SOT-23, Molded Plastic
- Case Material - UL Flammability Rating Classification 94V-0
- Terminals: Solderable per MIL-STD-202, Method 208
- Marking: Device Code
- Weight: 0.008 grams (approx.)



SOT-23		
Dim	Min	Max
A	0.37	0.51
B	1.20	1.40
C	2.30	2.50
D	0.89	1.03
E	0.45	0.60
G	1.78	2.05
H	2.80	3.00
J	0.013	0.10
K	0.903	1.10
L	0.45	0.61
M	0.085	0.180
α	0°	8°
All Dimensions in mm		

● MAXIMUM RATING ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit
Collector-Emitter Voltage	V_{CEO}	-40	Vdc
Collector-Base Voltage	V_{CBO}	-60	Vdc
Emitter-Base Voltage	V_{EBO}	-5	Vdc
Collector Current — Continuous	I_C	-200	mAdc

● THERMAL CHARACTERISTICS

Total Device Dissipation, FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225	mW
		1.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation, Alumina Substrate (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300	mW
		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage temperature	T_J, T_{stg}	-55 ~ +150	$^\circ\text{C}$

1. FR-5 = 1.0×0.75×0.062 in.

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



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Voltage - -40 Volts Power Dissipation - 300 mWatt

● ELECTRICAL CHARACTERISTICS (Ta= 25°C)

OFF CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector-Emitter Breakdown Voltage (Ic = -1.0 mA, IB = 0)	VBR(CEO)	-40	-	-	V
Collector-Base Breakdown Voltage (Ic = -10 μA, IE = 0)	VBR(CBO)	-40	-	-	V
Emitter-Base Breakdown Voltage (IE = -10 μA, IC = 0)	VBR(EBO)	-5	-	-	V
Collector Cutoff Current (VCE = -30 Vdc, VEB = -3.0Vdc)	ICEX	-	-	-50	nA
Base Cutoff Current (VCE = -30 Vdc, VEB = -3.0Vdc)	IBL	-	-	-50	nA

ON CHARACTERISTICS (Note 1.)

DC Current Gain (Ic = -0.1 mA, VCE = -1.0 Vdc)	hFE	60	-	-	
(Ic = -1.0 mA, VCE = -1.0 Vdc)		80	-	-	
(Ic = -10 mA, VCE = -1.0 Vdc)		100	-	300	
(Ic = -50 mA, VCE = -1.0 Vdc)		60	-	-	
(Ic = -100 mA, VCE = -1.0 Vdc)		30	-	-	
Collector-Emitter Saturation Voltage(3) (Ic = -10 mA, IB = -1.0 mA)	VCE(sat)	-	-	-0.25	V
(Ic = -50mA, IB = -5.0 mA)		-	-	-0.4	
Base-Emitter Saturation Voltage (Ic = -10 mA, IB = -1.0 mA)	VBE(sat)	-0.65	-	-0.85	V
(Ic = -50mA, IB = -5.0 mA)		-	-	-0.95	

SMALL-SIGNAL CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Current-Gain — Bandwidth Product (Ic = -10mA, VCE = -20Vdc, f = 100MHz)	fT	250	-	-	MHz
Output Capacitance (VCB = -5.0 Vdc, IE = 0, f = 1.0 MHz)	Cobo	-	-	4.5	pF
Input Capacitance (VEB = -0.5 Vdc, Ic = 0, f = 1.0 MHz)	Cibo	-	-	10	pF
Input Impedance (VCE = -10 Vdc, Ic = -1.0mA, f = 1.0 kHz)	hie	2	-	12	kΩ
Voltage Feedback Ratio (VCE = -10 Vdc, Ic = -1.0mA, f = 1.0 kHz)	hre	0.1	-	10	X 10 ⁻⁴
Small-Signal Current Gain (VCE = -10 Vdc, Ic = -1.0mA, f = 1.0 kHz)	hfe	100	-	400	
Output Admittance (VCE = -10 Vdc, Ic = -1.0mA, f = 1.0kHz)	hoe	3	-	60	μhos
Noise Figure (VCE = -5V, Ic = -100μA, RS = 1.0kΩ, f = 1.0kHz)	NF	-	-	4	dB

3. Pulse Test: Pulse Width <300 μs, Duty Cycle <2.0%.



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RATINGS AND CHARACTERISTIC CURVES

● ELECTRICAL CHARACTERISTICS (Ta= 25°C)

SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = -3.0 Vdc, V _{BE} = 0.5 Vdc, I _C = -10 mA, I _{B1} = -1.0 mA)	t _d	-	-	35	ns
Rise Time	(V _{CC} = -3.0 Vdc, I _C = -10 mA, I _{B1} = -1.0 mA)	t _r	-	-	35	
Storage Time	(V _{CC} = -3.0 Vdc, I _C = -10 mA, I _{B1} = I _{B2} = -1.0 mA)	t _s	-	-	225	
Fall Time	(V _{CC} = -3.0 Vdc, I _C = -10 mA, I _{B1} = I _{B2} = -1.0 mA)	t _f	-	-	75	

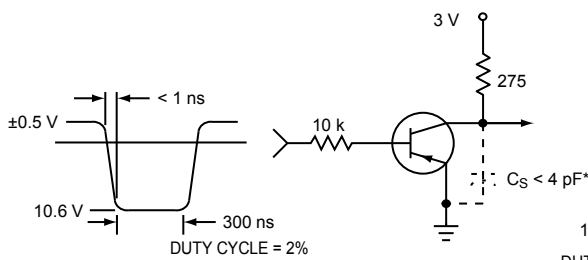


Figure 1. Delay and Rise Time Equivalent Test Circuit

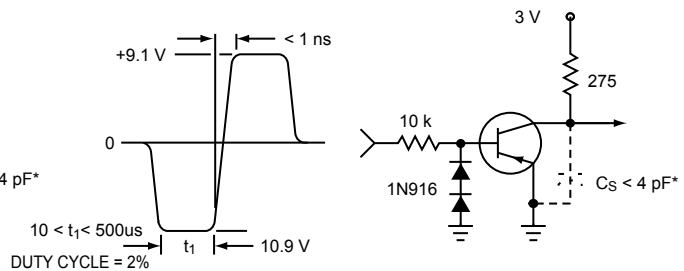


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

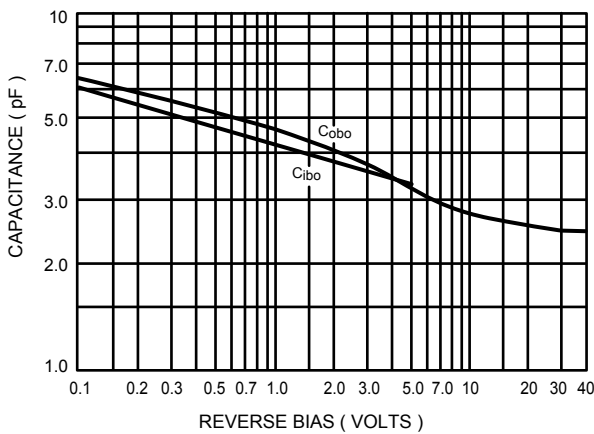


Figure 3. Capacitance

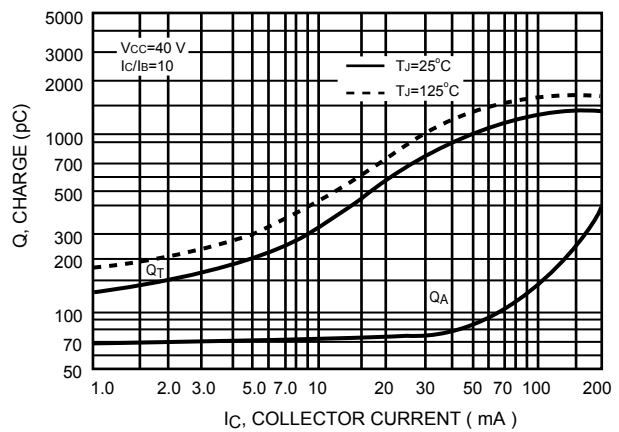


Figure 4. Charge Data

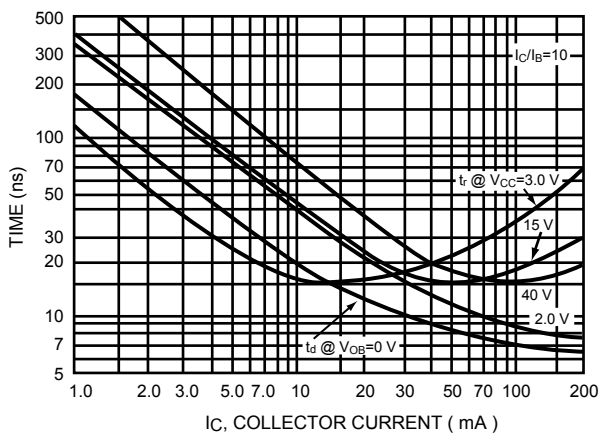


Figure 5. Turn-On Time

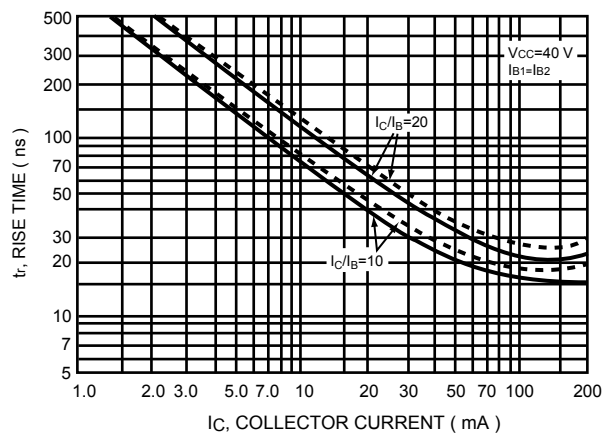


Figure 6. Fall Time



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RATINGS AND CHARACTERISTIC CURVES

TYPICAL TRANSIENT CHARACTERISTICS NOISE FIGURE VARIATIONS

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

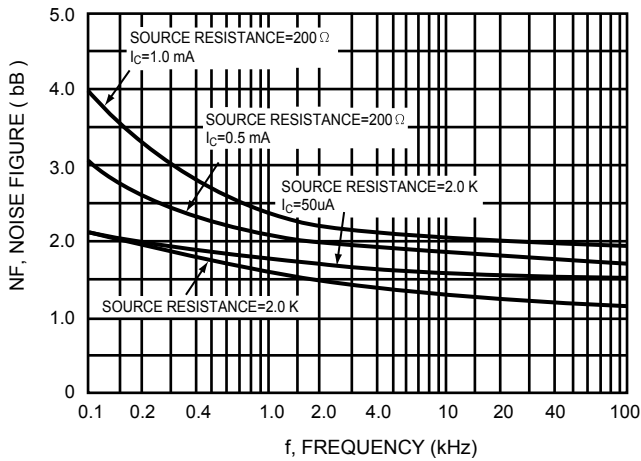


Figure 7.

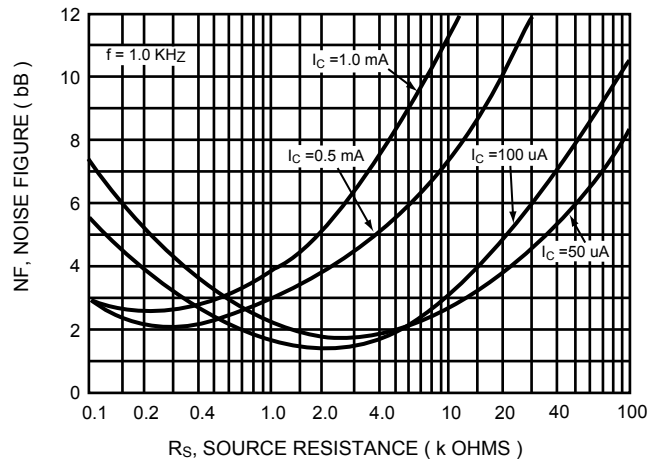


Figure 8.

h PARAMETERS

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

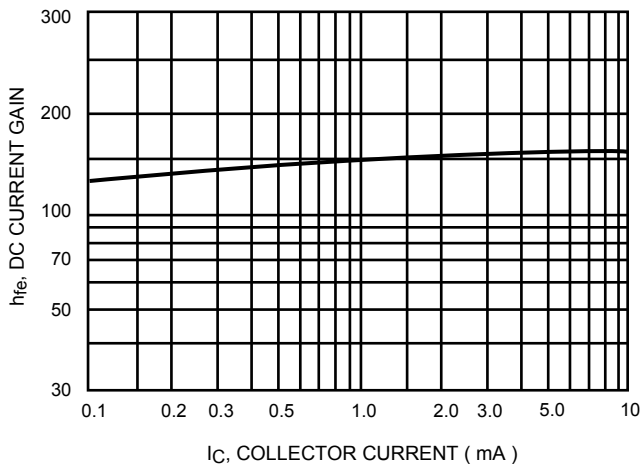


Figure 9. Current Gain

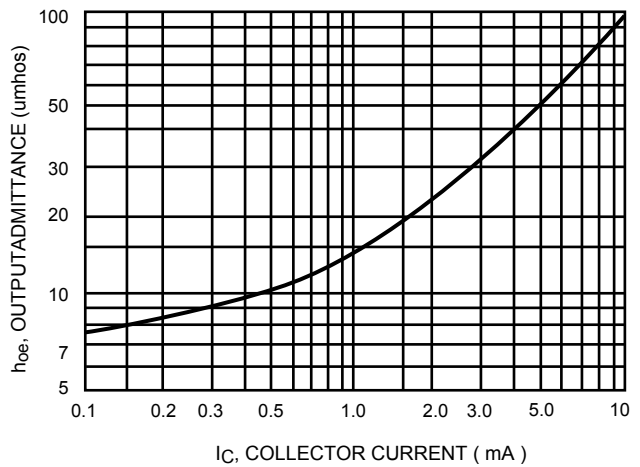


Figure 10. Output Admittance

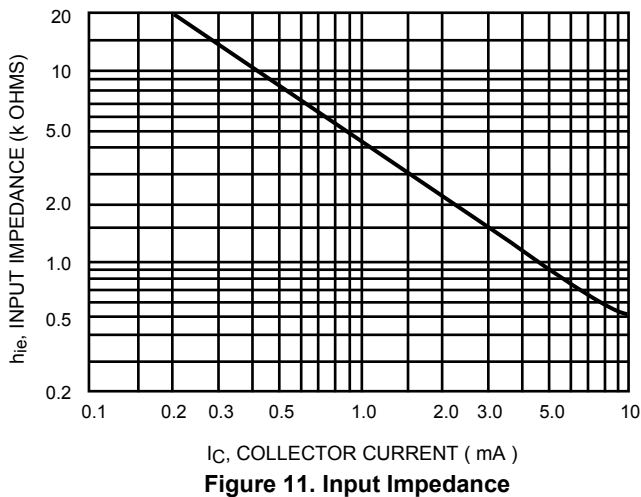


Figure 11. Input Impedance

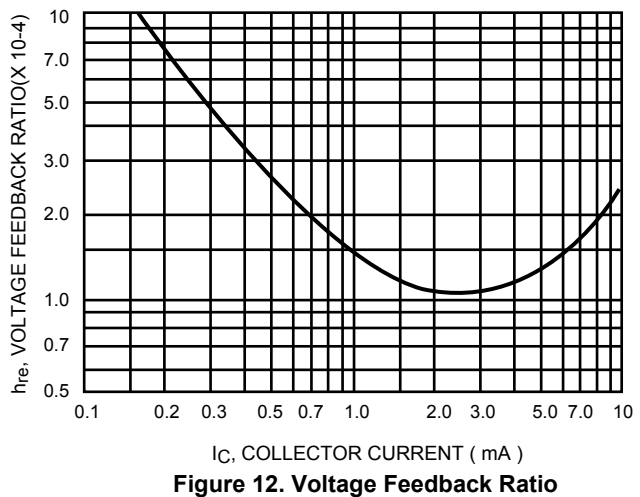


Figure 12. Voltage Feedback Ratio



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RATINGS AND CHARACTERISTIC CURVES

TYPICAL STATIC CHARACTERISTICS

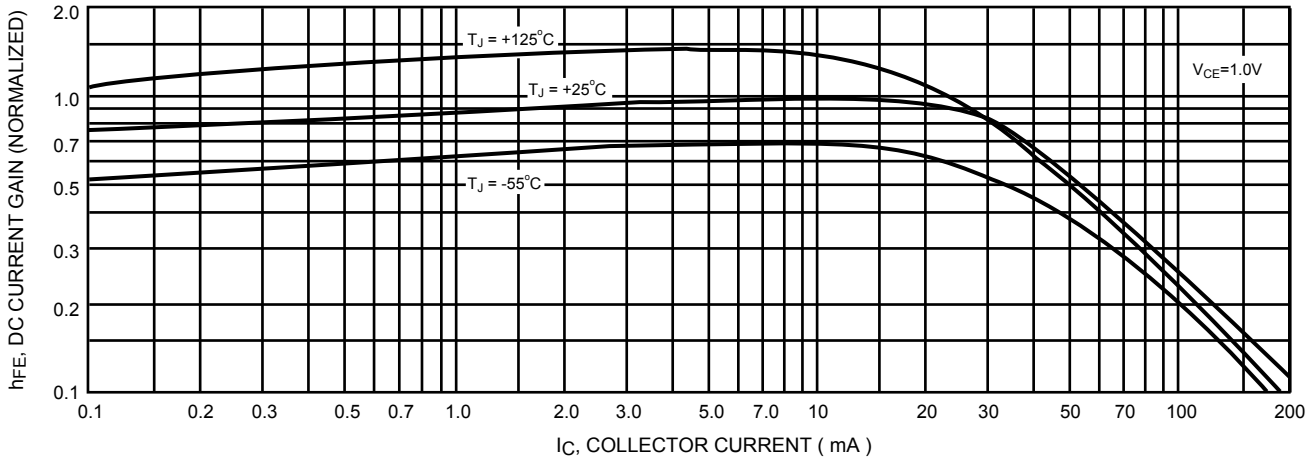


Figure 13. DC Current Gain

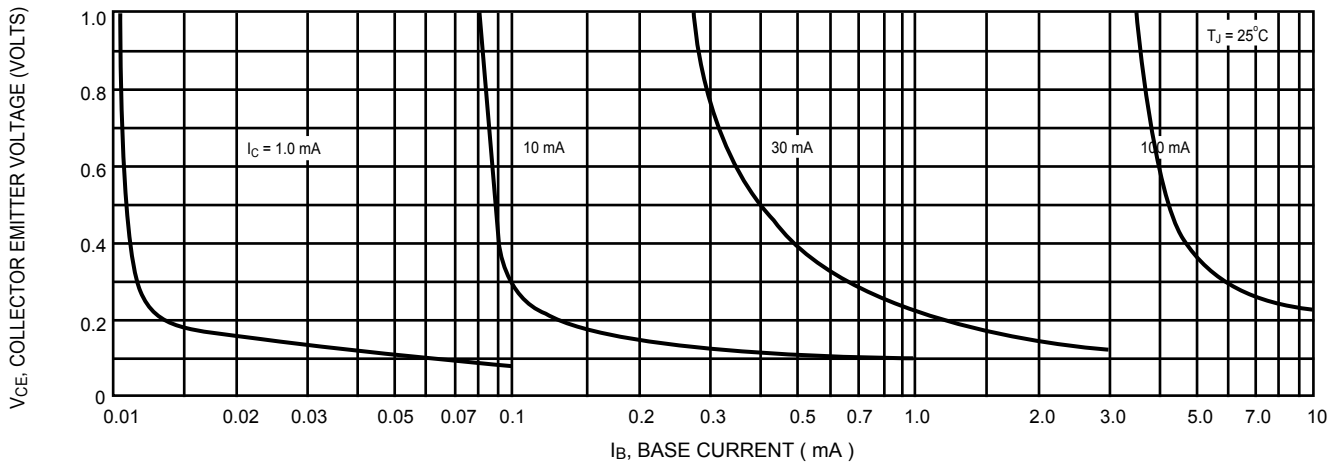


Figure 14. Collector Saturation Region

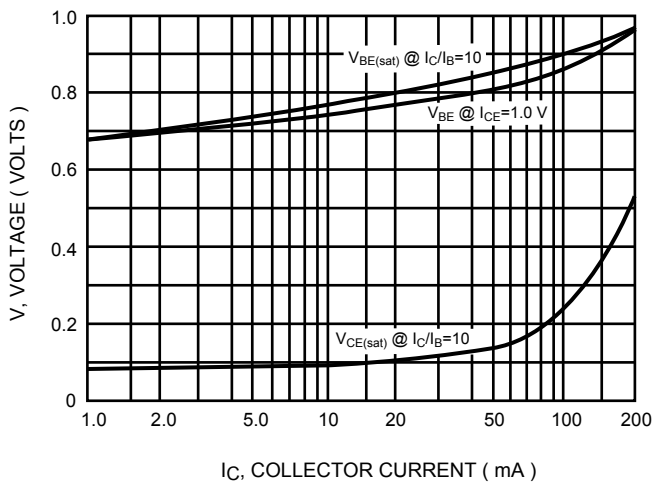


Figure 17. " ON " Voltage

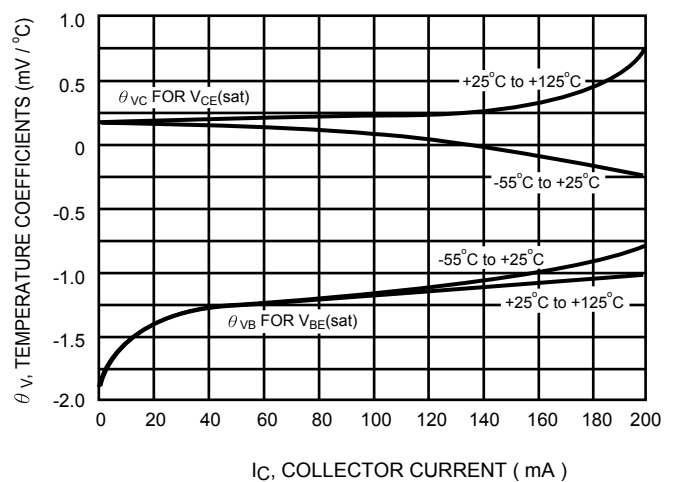


Figure 16. Temperature Coefficients