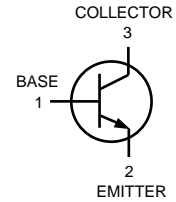
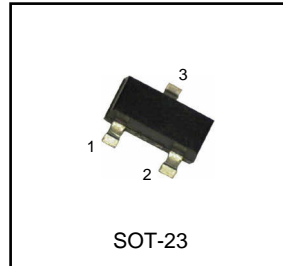


# General Purpose Transistor

## NPN Silicon

**MMBT3906**



### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	-40	V <sub>d</sub> c
Collector-Base Voltage	V <sub>CBO</sub>	-40	V <sub>d</sub> c
Emitter-Base Voltage	V <sub>EBO</sub>	-5.0	V <sub>d</sub> c
Collector Current-Continuous	I <sub>C</sub>	-200	mA <sub>d</sub> c

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Total Device Dissipation FR-5 Board <sup>(1)</sup> T <sub>A</sub> =25°C Derate above 25°C	P <sub>D</sub>	225 1.8	mW mW / °C
Thermal Resistance Junction to Ambient	R <sub>θJA</sub>	556	°C / W
Total Device Dissipation Alumina Substrate, <sup>(2)</sup> T <sub>A</sub> =25°C Derate above 25°C	P <sub>D</sub>	300 2.4	mW mW / °C
Thermal Resistance Junction to Ambient	R <sub>θJA</sub>	417	°C / W
Junction and Storage Temperature	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

### DEVICE MARKING

MMBT3906=2A

### ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Max.	Unit
----------------	--------	------	------	------

### OFF CHARACTERISTICS

Collector-Emitter Breakdowe Voltage <sup>(3)</sup> ( I <sub>C</sub> =1.0mA <sub>d</sub> c, I <sub>B</sub> =0 )	V <sub>(BR)CEO</sub>	-40	-	V <sub>d</sub> c
Collector-Base Breakdowe Voltage ( I <sub>C</sub> = -10 uA <sub>d</sub> c, I <sub>E</sub> =0 )	V <sub>(BR)CBO</sub>	-40	-	V <sub>d</sub> c
Emitter-Base Breakdowe Voltage ( I <sub>E</sub> = -10 uA <sub>d</sub> c, I <sub>C</sub> =0 )	V <sub>(BR)EBO</sub>	-5.0	-	V <sub>d</sub> c
Base Cutoff Current ( V <sub>CE</sub> = -30 V <sub>d</sub> c, V <sub>EB</sub> = -3.0 V <sub>d</sub> c )	I <sub>BL</sub>	-	-50	nA <sub>d</sub> c
Collector Cutoff Current ( V <sub>CE</sub> = -30 V <sub>d</sub> c, V <sub>EB</sub> = -3.0 V <sub>d</sub> c )	I <sub>CEX</sub>	-	-50	nA <sub>d</sub> c

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

Characteristic	Symbol	Min.	Max.	Unit
<b>ON CHARACTERISTICS<sup>(3)</sup></b>				
DC Current Gain ( IC= -0.1 mA <sub>dc</sub> , VCE= -1.0 V <sub>dc</sub> ) ( IC= -1.0 mA <sub>dc</sub> , VCE= -1.0 V <sub>dc</sub> ) ( IC= -10 mA <sub>dc</sub> , VCE= -1.0 V <sub>dc</sub> ) ( IC= -50 mA <sub>dc</sub> , VCE= -1.0 V <sub>dc</sub> ) ( IC= -100 mA <sub>dc</sub> , VCE= -1.0 V <sub>dc</sub> )	HFE	60 80 100 60 30	- - 300 - -	-
Collector-Emitter Saturation Voltage <sup>(3)</sup> ( IC= -10 mA <sub>dc</sub> , IB= -1.0 mA <sub>dc</sub> ) ( IC= -50 mA <sub>dc</sub> , IB= -5.0 mA <sub>dc</sub> )	VCE(sat)	- -	-0.25 -0.4	V <sub>dc</sub>
Base-Emitter Saturation Voltage <sup>(3)</sup> ( IC= -10 mA <sub>dc</sub> , IB= -1.0 mA <sub>dc</sub> ) ( IC= -50 mA <sub>dc</sub> , IB= -5.0 mA <sub>dc</sub> )	VBE(sat)	-0.65 -	-0.85 -0.95	V <sub>dc</sub>

**SMALL-SIGNAL CHARACTERISTIC**

Current-Gain-Bandwidth Product ( IC= -10 mA <sub>dc</sub> , VCE= -20 V <sub>dc</sub> , f=100 MHz )	fT	250	-	MHz
Output Capacitance ( VCB= -5.0 V <sub>dc</sub> , IE=0, f=1.0 MHz )	Cobo	-	4.5	pF
Input Capacitance ( VEB= -0.5 V <sub>dc</sub> , IC=0, f=1.0 MHz )	Cibo	-	10	pF
Input Impedance ( VCE= -10 V <sub>dc</sub> , IC= -1.0 mA <sub>dc</sub> , f=1.0 kHz )	hie	2.0	12	k ohms
Voltage Feedback Ratio ( VCE= -10 V <sub>dc</sub> , IC= -1.0 mA <sub>dc</sub> , f=1.0 kHz )	hre	0.1	10	X 10 <sup>-4</sup>
Small-Signal Current Gain ( VCE= -10 V <sub>dc</sub> , IC= -1.0 mA <sub>dc</sub> , f=1.0 kHz )	hfe	100	400	-
Output Admittance ( VCE= -10 V <sub>dc</sub> , IC= -1.0 mA <sub>dc</sub> , f=1.0 kHz )	hoe	3.0	60	u mhos
Noise Figure ( VCE= -5.0 V <sub>dc</sub> , IC= -100 uA <sub>dc</sub> , RS=1.0 k ohm, f=1.0 kHz )	NF	-	4.0	dB

**SWITCHING CHARACTERISTICS**

Delay Time	( VCC= -3.0 V <sub>dc</sub> , VBE= -0.5 V <sub>dc</sub> , IC= -10 mA <sub>dc</sub> , IB1= -1.0 mA <sub>dc</sub> )	td	-	35	nS
Rise Time		tr	-	35	
Storage Time	( VCC= -3.0 V <sub>dc</sub> , IC= -10 mA <sub>dc</sub> , IB1=IB2= -1.0 mA <sub>dc</sub> )	ts	-	225	nS
Fall Time		tf	-	75	

(1) FR-5=1.0 x 0.75 x 0.062in.

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

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

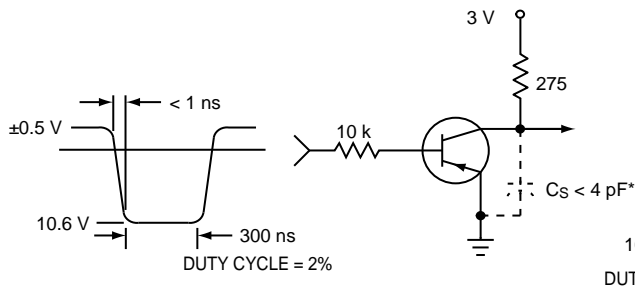


Figure 1. Delay and Rise Time Equivalent Test Circuit

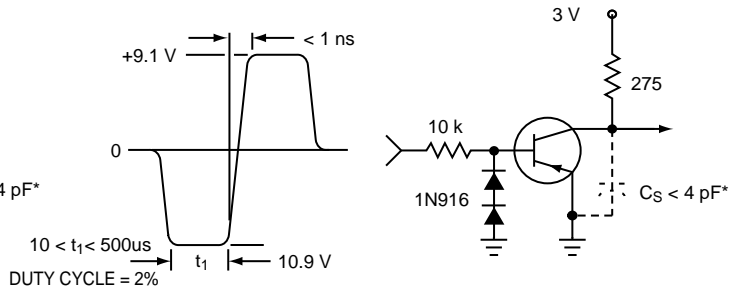


Figure 2. Storage and Fall Time Equivalent Test Circuit

\* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

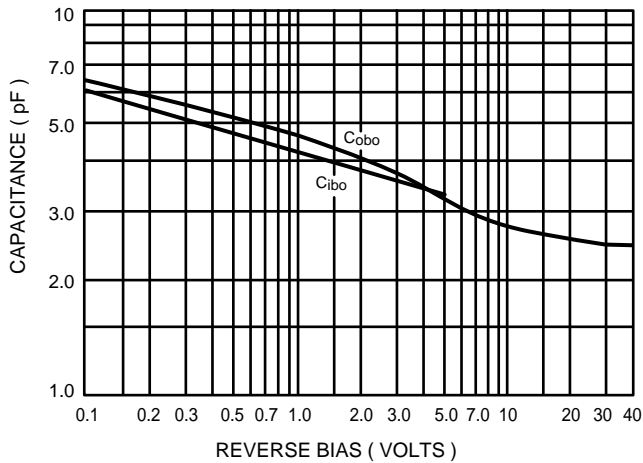


Figure 3. Capacitance

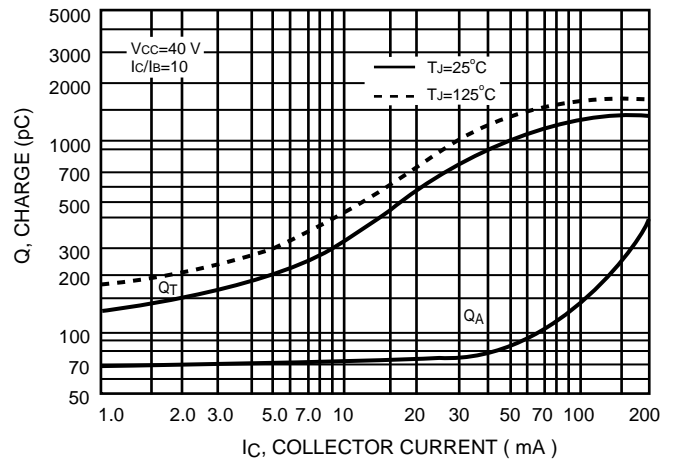


Figure 4. Charge Data

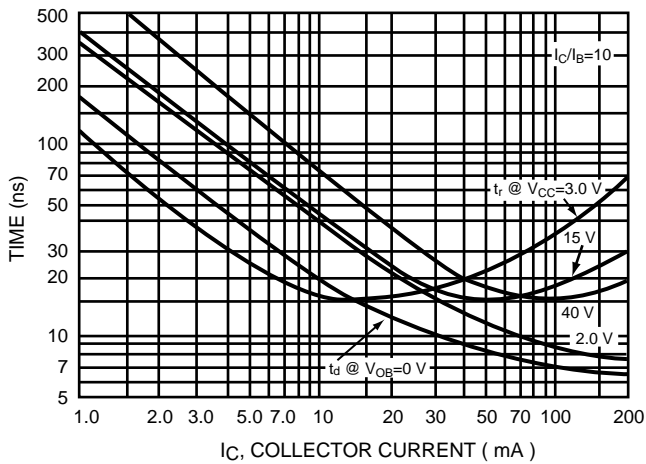


Figure 5. Turn-On Time

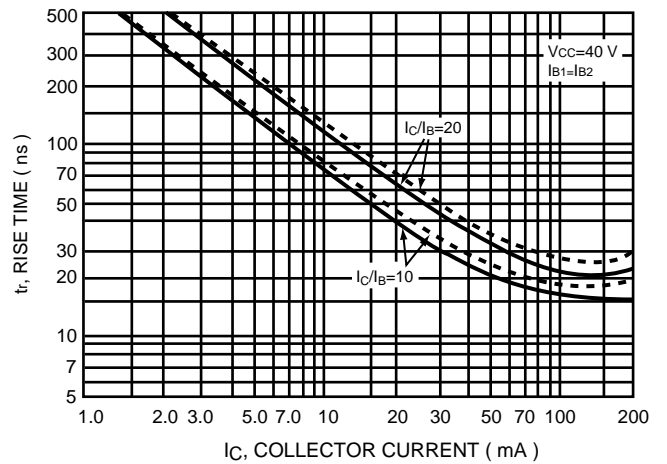


Figure 6. Fall Time

**TYPICAL TRANSIENT CHARACTERISTICS  
NOISE FIGURE VARIATIONS**

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

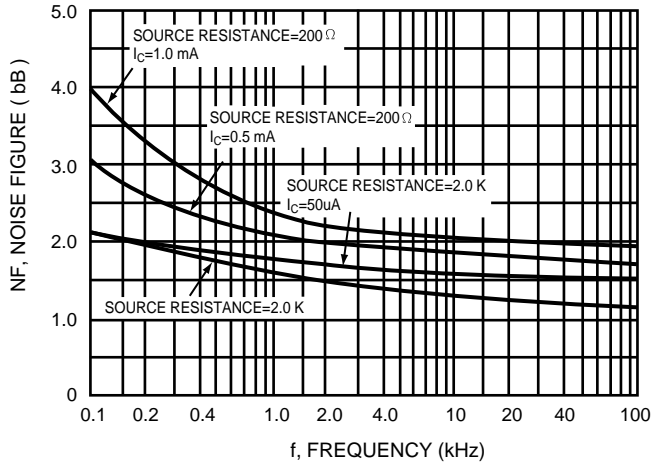


Figure 7.

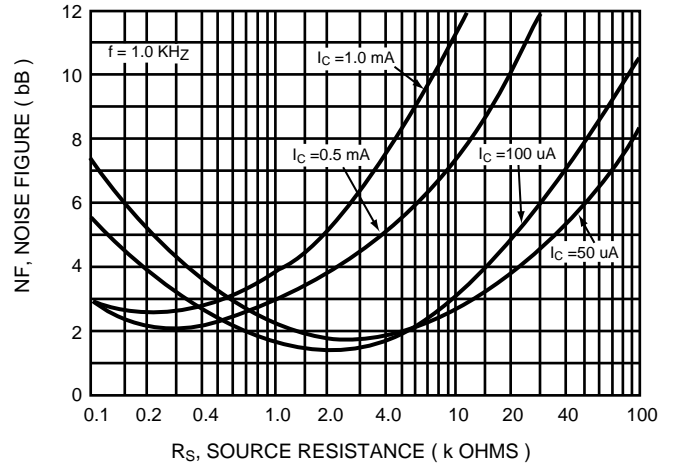
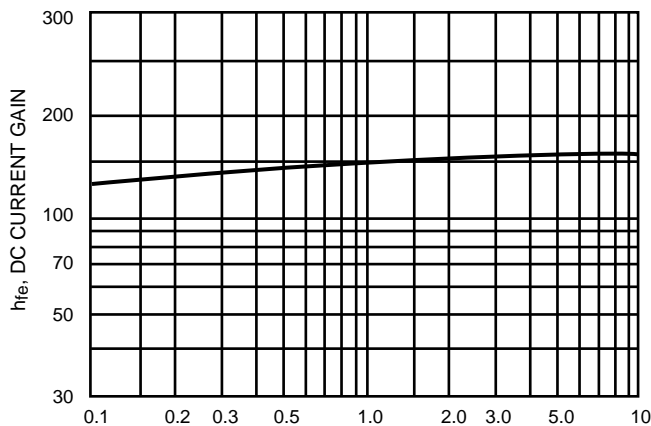


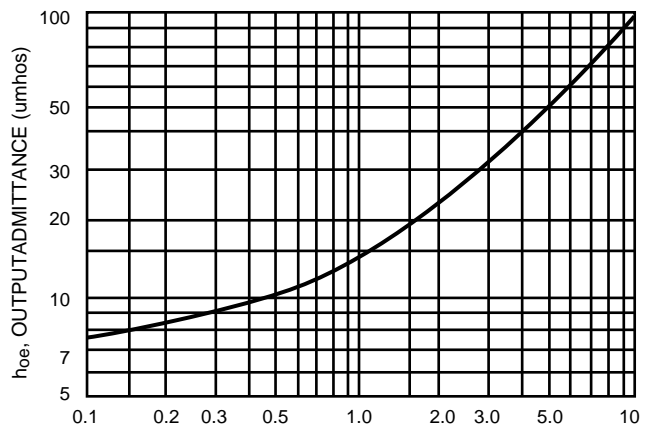
Figure 8.

**h PARAMETERS**

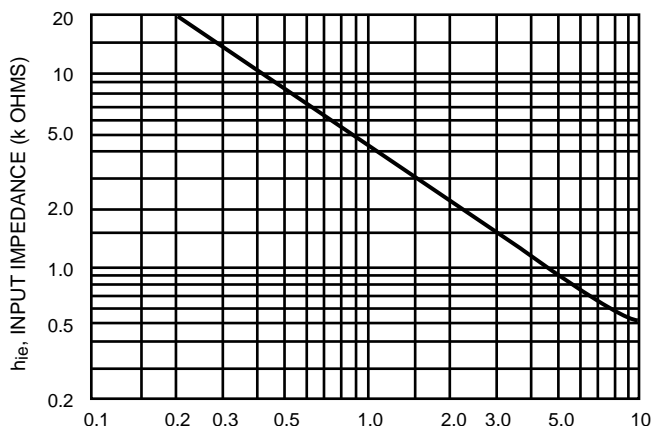
( $V_{CE} = -10V_{dc}$ ,  $f = 1.0\text{ kHz}$ ,  $T_A = 25^\circ C$ )



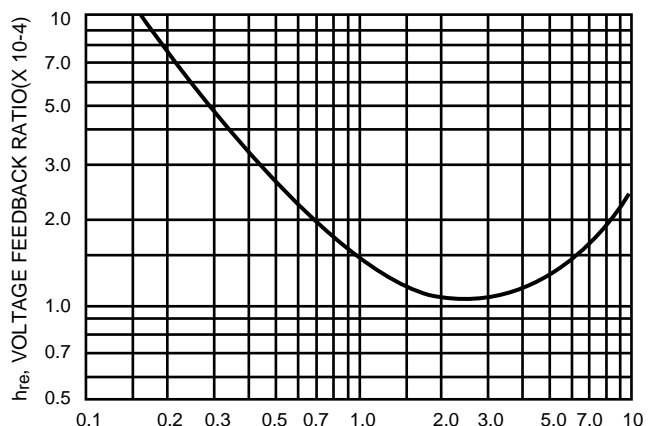
$I_C$ , COLLECTOR CURRENT ( mA )  
Figure 9. Current Gain



$I_C$ , COLLECTOR CURRENT ( mA )  
Figure 10. Output Admittance



$I_C$ , COLLECTOR CURRENT ( mA )  
Figure 11. Input Impedance



$I_C$ , COLLECTOR CURRENT ( mA )  
Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

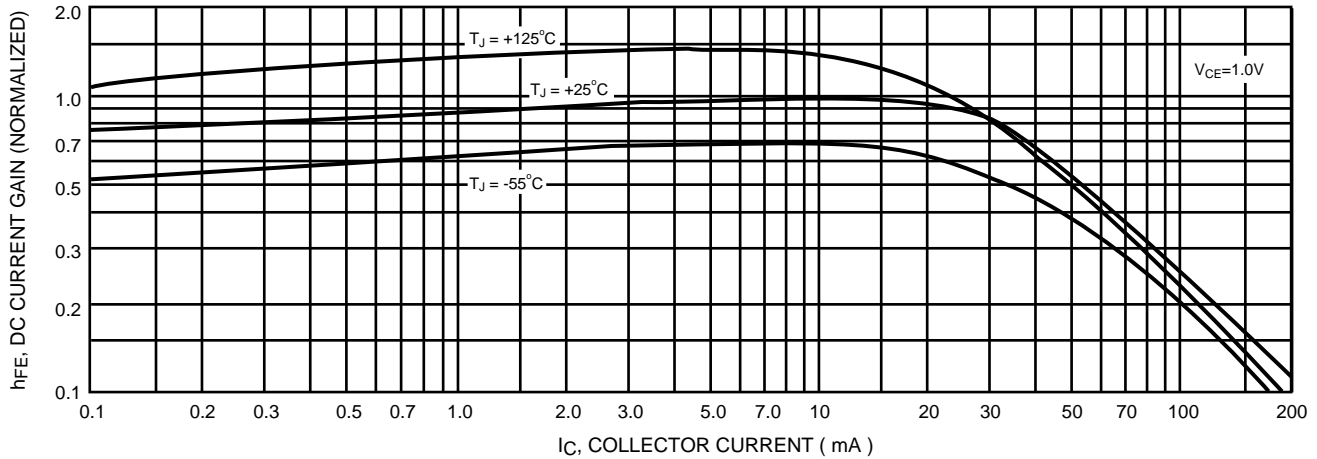


Figure 13. DC Current Gain

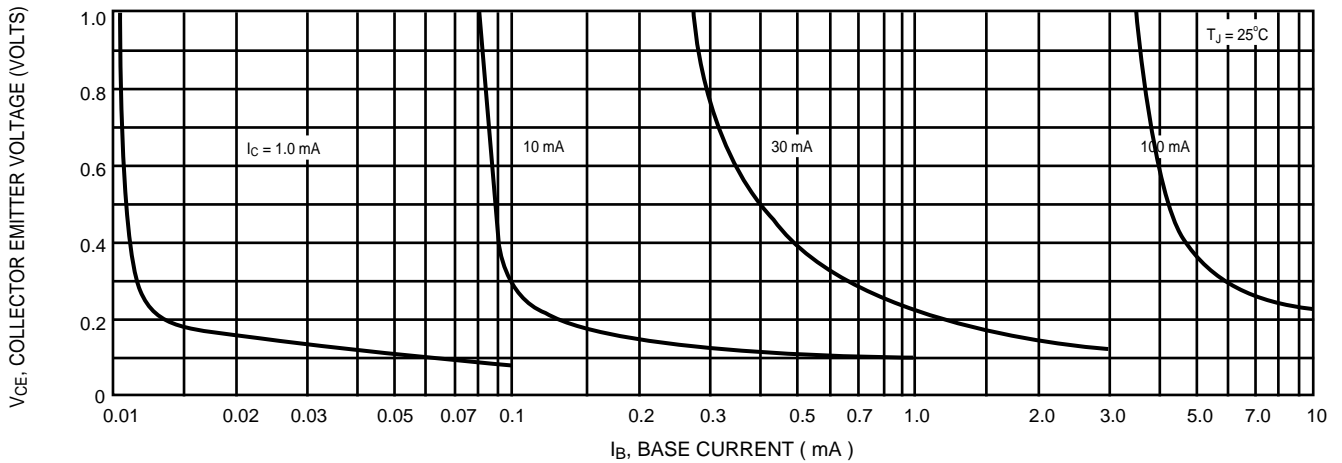


Figure 14. Collector Saturation Region

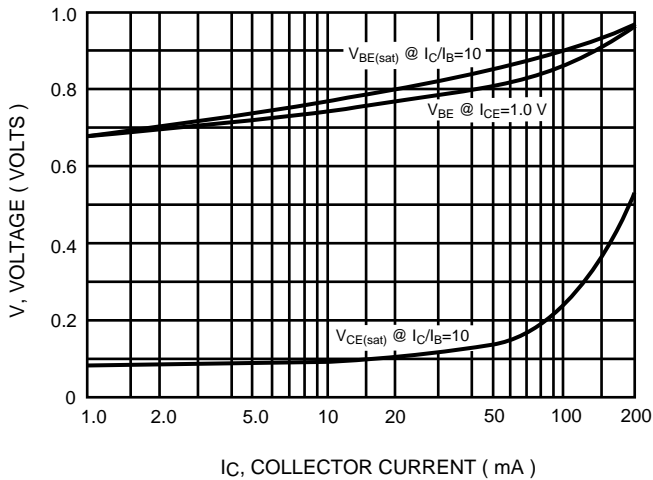


Figure 17. " ON " Voltage

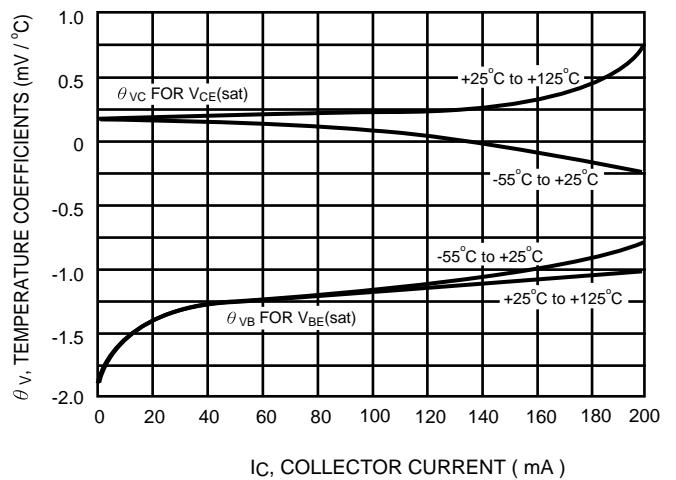


Figure 16. Temperature Coefficients