

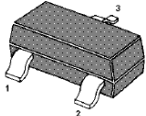


# MMBT3906

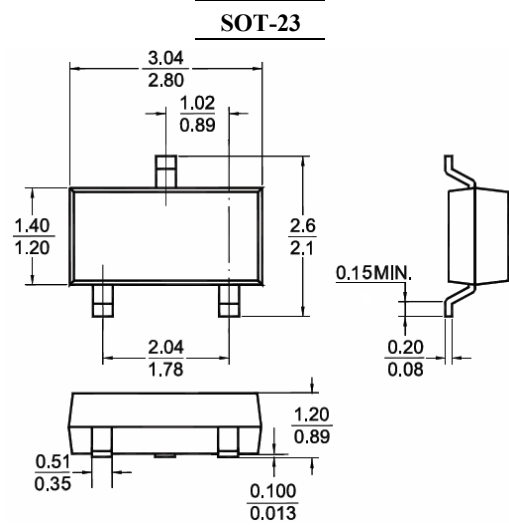
## PNP TRANSISTOR

### FEATURES

- As complementary types the NPN transistors MMBT3904 is recommended
- Suffix "H" indicates Halogen-free parts, ex. MMBT3906H



1, Base 2, Emitter 3, Collector



Dimensions in millimeter

### Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	-40	V
Collector-Emitter Voltage	$V_{CEO}$	-40	V
Emitter-Base Voltage	$V_{EBO}$	-5.0	V
Collector Current	$I_C$	-200	mA
Total Device Dissipation FR-5 Board <sup>(1)</sup> Derate above 25°C	$P_D$	225 1.8	mW mW / °C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	°C / W
Total Device Dissipation Alumina Substrate <sup>(2)</sup> Derate above 25°C	$P_D$	300 2.4	mW mW / °C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	417	°C / W
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C

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

(2) Device on alumina substrate = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Conditions	Symbol	Min.	Max.	Unit
Collector-base breakdown voltage	$I_C = -10\mu\text{A}, I_E = 0$	$V_{(BR)CBO}$	-40	--	V
Collector-emitter breakdown voltage <sup>(3)</sup>	$I_C = -1.0\text{mA}, I_B = 0$	$V_{(BR)CEO}$	-40	--	V
Emitter-base breakdown voltage	$I_E = -10\mu\text{A}, I_C = 0$	$V_{(BR)EBO}$	-5.0	--	V
Base cut-off current	$V_{CE} = -30\text{V}, V_{EB} = -3.0\text{V}$	$I_{BL}$	--	-50	nA
Collector cut-off current	$V_{CE} = -30\text{V}, V_{EB} = -3.0\text{V}$	$I_{CEX}$	--	-50	nA
DC current gain	$V_{CE} = -1.0\text{V}, I_C = -0.1\text{mA}$	$h_{FE}$	60	--	--
	$V_{CE} = -1.0\text{V}, I_C = -1.0\text{mA}$		80	--	
	$V_{CE} = -1.0\text{V}, I_C = -10\text{mA}$		100	300	
	$V_{CE} = -1.0\text{V}, I_C = -50\text{mA}$		60	--	
	$V_{CE} = -1.0\text{V}, I_C = -100\text{mA}$		30	--	
Collector-emitter saturation voltage <sup>(3)</sup>	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$	$V_{CE(sat)}$	--	-0.25	V
	$I_C = -50\text{mA}, I_B = -5.0\text{mA}$		--	-0.4	
Base-emitter saturation voltage <sup>(3)</sup>	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$	$V_{BE(sat)}$	-0.65	-0.85	V
	$I_C = -50\text{mA}, I_B = -5.0\text{mA}$		--	-0.95	

(3) Pulse Test: Pulse Width <300  $\mu\text{s}$ , Duty Cycle <2.0%.



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### Electrical Characteristics ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Parameter	Conditions	Symbol	Min.	Max.	Unit
Current-gain — bandwidth product	$V_{CE} = -20\text{V}$ , $I_C = -10\text{mA}$ , $f = 100\text{MHz}$	$f_T$	250	--	MHz
Output capacitance	$V_{CB} = -5.0\text{V}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$	$C_{obo}$	--	4.5	pF
Input capacitance	$V_{BE} = -0.5\text{V}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$	$C_{ibo}$	--	10	pF
Input impedancen	$V_{CE} = -10\text{V}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{ kHz}$	$h_{ie}$	2.0	12	k $\Omega$
Voltage feedback Ratio	$V_{CE} = -10\text{V}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{ kHz}$	$h_{re}$	0.1	10	$\times 10^{-4}$
Small-signal current gain	$V_{CE} = -10\text{V}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{ kHz}$	$h_{fe}$	100	400	--
Output admittance	$V_{CE} = -10\text{V}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{ kHz}$	$h_{oe}$	3.0	60	$\mu\text{hos}$
Noise figure	$V_{CE} = -5.0\text{V}$ , $I_C = -100\mu\text{A}$ , $R_S = 1.0\text{k } \Omega$ , $f = 1.0\text{ kHz}$	NF	--	4.0	dB
Delay time	$V_{CC} = -3.0\text{V}$ , $V_{BE} = 0.5\text{V}$	$t_d$	--	35	nS
Rise time	$I_C = -10\text{mA}$ , $I_{B1} = -1.0\text{mA}$	$t_r$	--	35	nS
Storage time	$V_{CC} = -3.0\text{V}$ , $I_C = -10\text{mA}$	$t_s$	--	225	nS
Fall time	$I_{B1} = I_{B2} = -1.0\text{mA}$	$t_f$	--	75	nS



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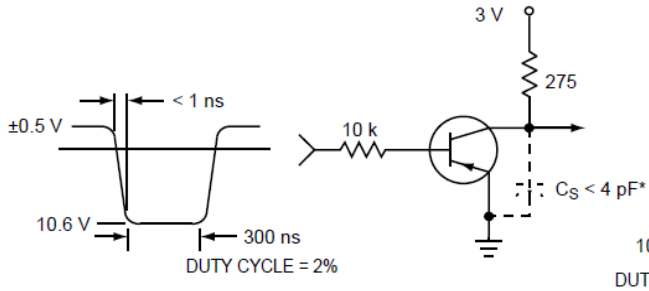


Figure 1. Delay and Rise Time  
Equivalent Test Circuit

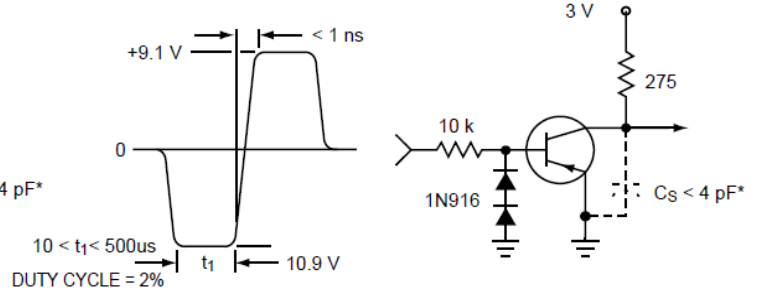


Figure 2. Storage and Fall Time  
Equivalent Test Circuit

\* Total shunt capacitance of test jig and connectors

### RATINGS AND CHARACTERISTIC CURVES

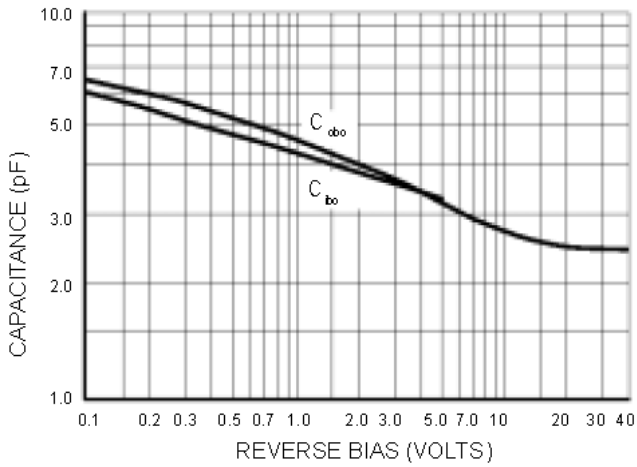


Figure 3. Capacitance

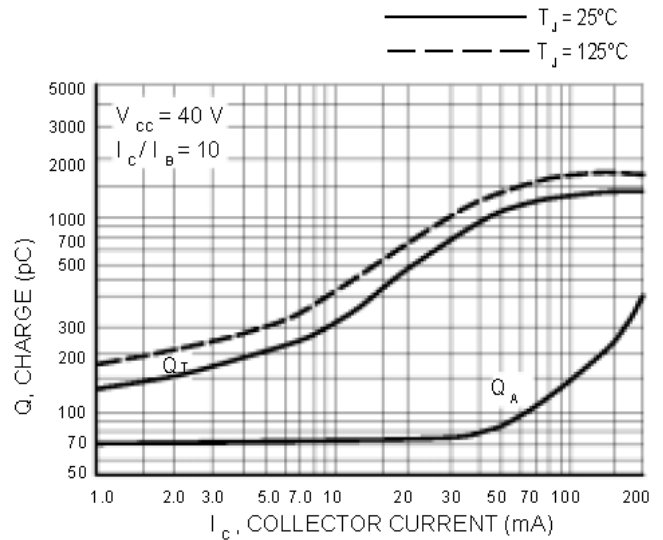


Figure 4. Charge Data

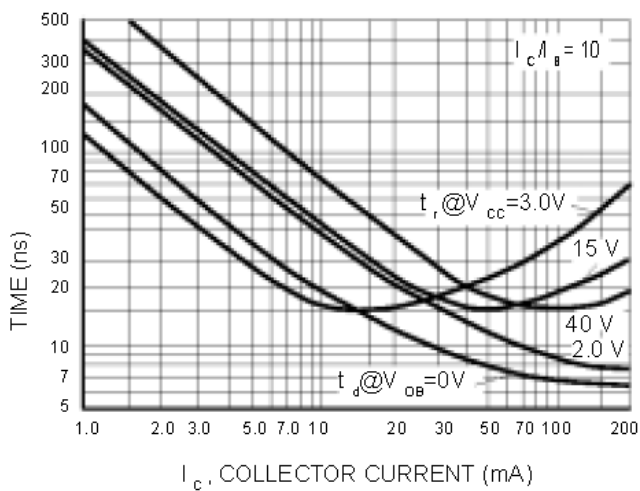


Figure 5. Turn-On Time

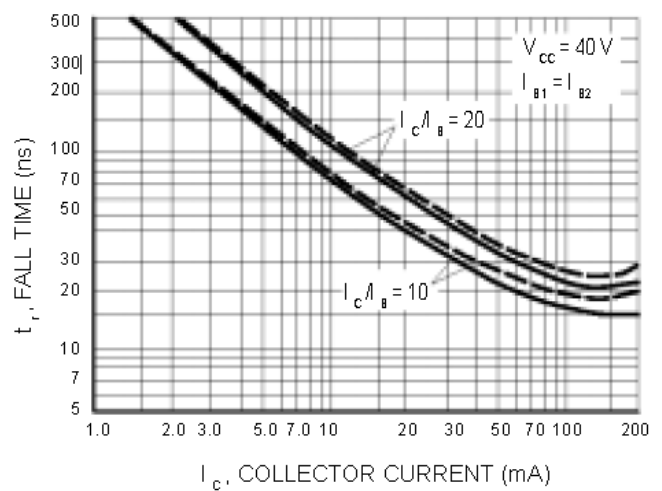


Figure 6. Fall Time



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### RATINGS AND CHARACTERISTIC CURVES

#### TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS

##### NOISE FIGURE VARIATIONS

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

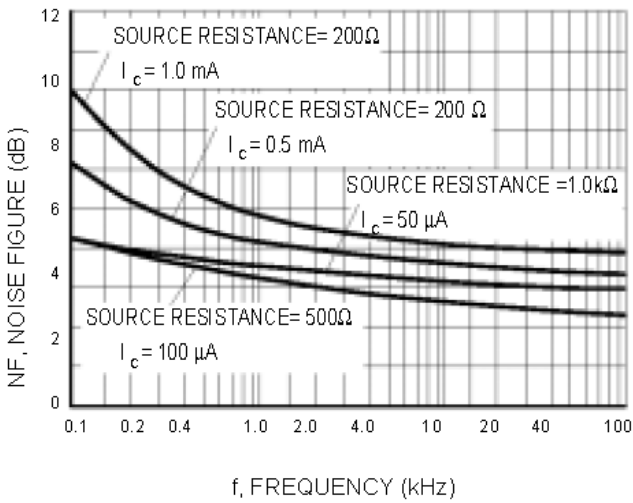


Figure 7. Noise Figure

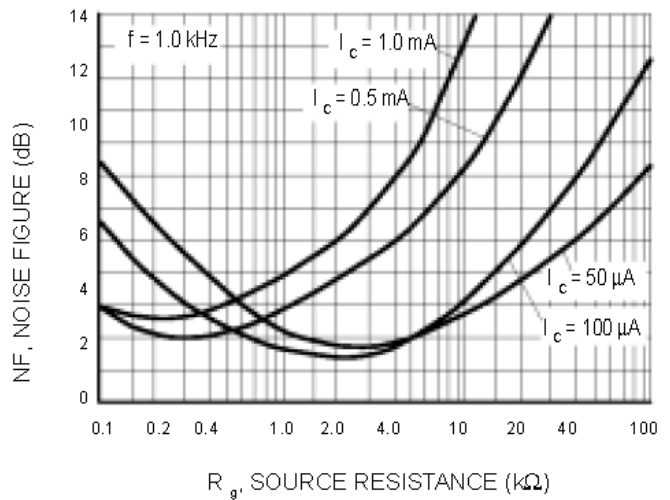


Figure 8. Noise Figure

#### *h* PARAMETERS

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

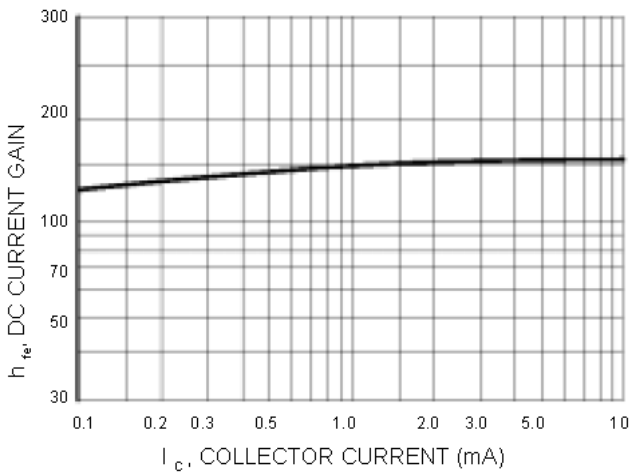


Figure 9. Current Gain

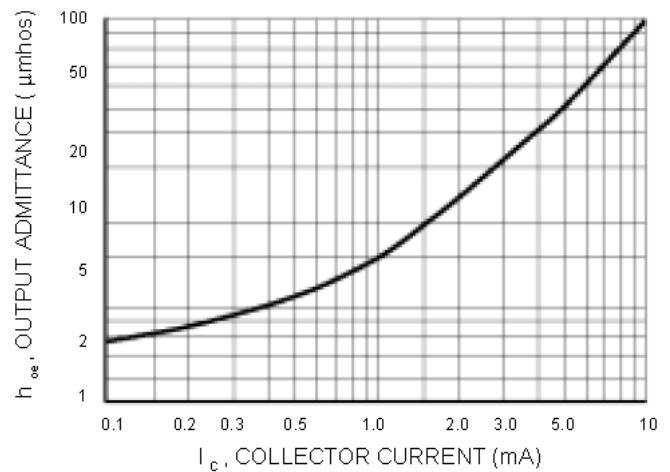


Figure 10. Output Admittance

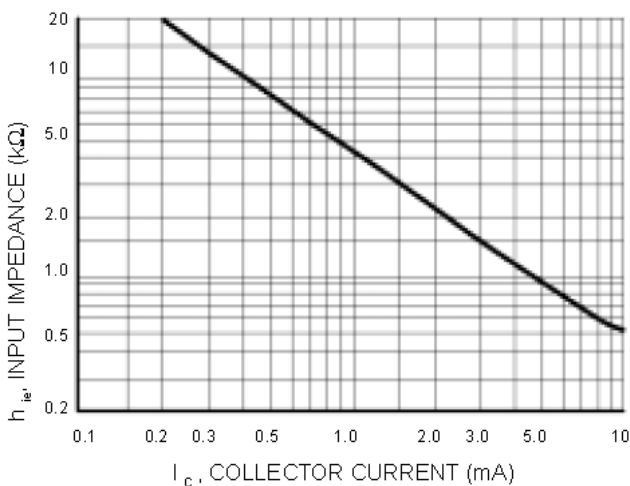


Figure 11. Input Impedance

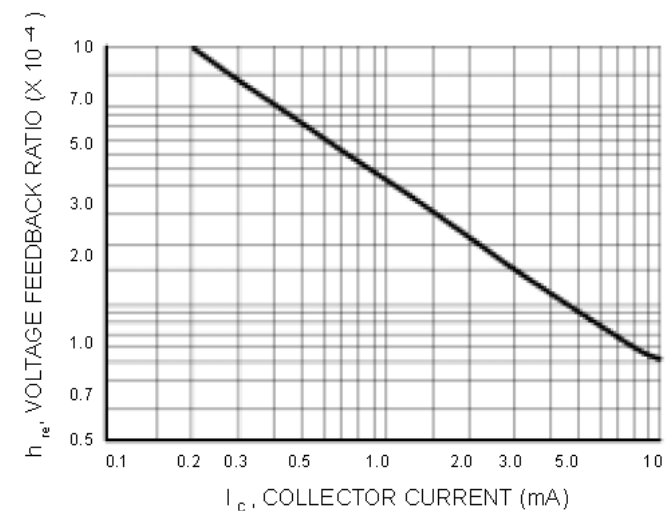


Figure 12. Voltage Feedback Ratio



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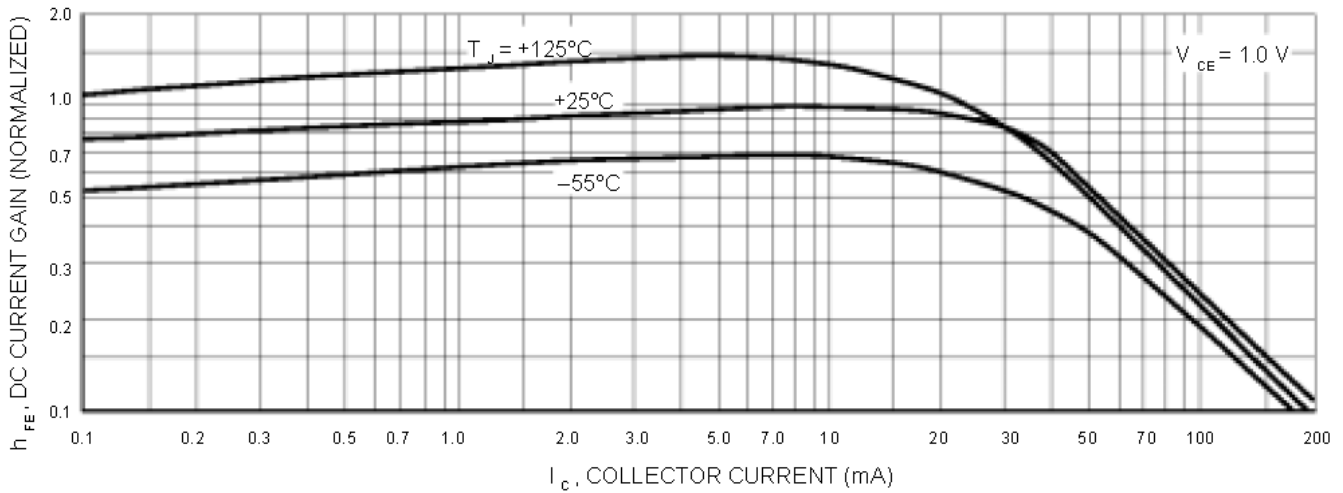


Figure 13. DC Current Gain

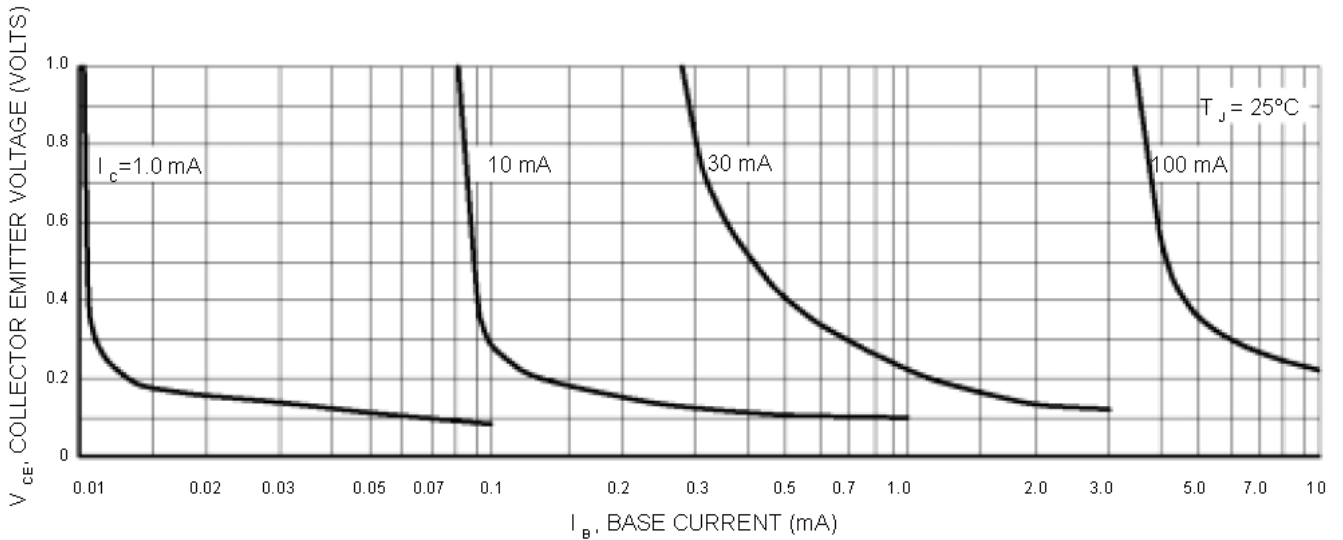


Figure 14. Collector Saturation Region

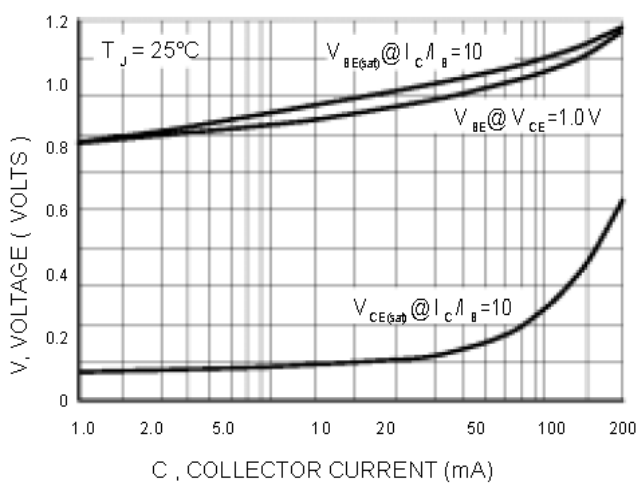


Figure 15. "ON" Voltages

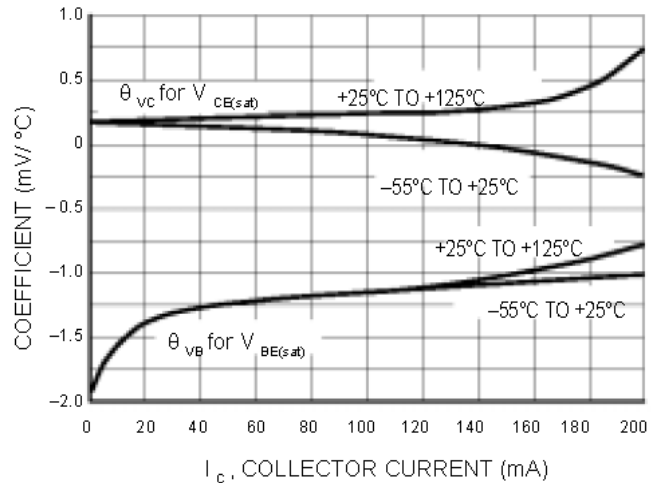


Figure 16. Temperature Coefficients