Elektronische Bauelemente

MMBT3904FW

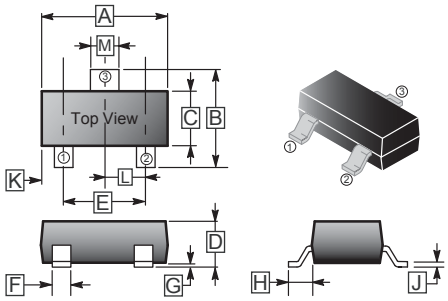
NPN Silicon
General Purpose Transistors

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.

SOT-523



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.5	1.7	G	-	0.1
B	1.45	1.75	H	0.55 REF.	
C	0.7	0.9	J	0.1	0.2
D	0.7	0.9	K	-	
E	0.9	1.1	L	0.5 TYP.	
F	0.15	0.25	M	0.25	0.35

MARKING

1N

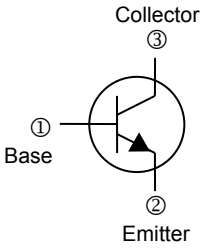
AM

PACKAGE INFORMATION

Package	MPQ	Leader Size
SOT-523	3K	7 inch

ORDER INFORMATION

Part Number	Type
MMBT3904FW	Lead (Pb)-free
MMBT3904FW-C	Lead (Pb)-free and Halogen-free



MAXIMUM RATINGS (at T_a = 25°C unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Collector - Emitter Voltage	V_{CEO}	40	Vdc
Collector - Base Voltage	V_{CBO}	60	Vdc
Emitter - Base Voltage	V_{EBO}	6	Vdc
Collector Current - Continuous	I_C	200	mAdc
Total Device Dissipation FR-4 Board(1) T_A=25°C, Derate above 25°C	P_D	200	mW
		1.6	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	600	°C / W
Total Device Dissipation FR-4 Board(2) T_A=25°C, Derate above 25°C	P_D	300	mW
		2.4	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	400	°C / W
Junction & Storage Temperature	T_J, T_{STG}	-55 ~ 150	°C

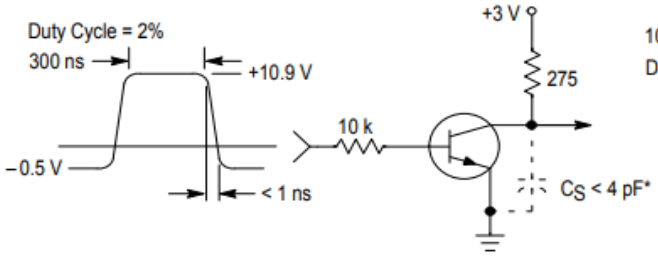
Note:
1. FR-4 Minimum Pad.
2. FR-4 1.0 X 1.0 Inch Pad.
3. Pulse Test：Pulse Width ≦ 300 μs, Duty Cycle ≦ 2.0%.

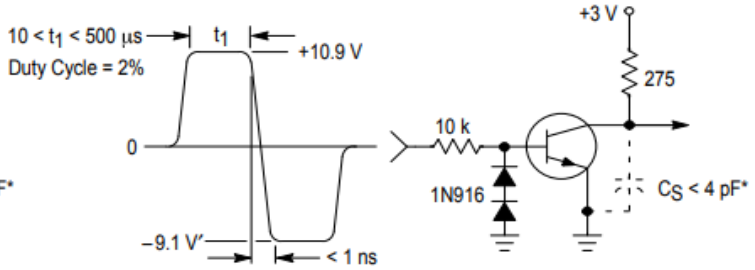
ELECTRICAL CHARACTERISTICS (at T_a = 25°C unless otherwise specified)

Parameter	Symbol	Min.	Max.	Unit	Test conditions
Off Characteristics					
Collector-Emitter Breakdown Voltage[1]	$V_{(BR)CEO}$	40	-	V	I_C =1mA, I_B = 0
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60	-	V	I_C =10μA, I_E = 0
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6	-	V	I_E =10μA, I_C = 0
Collector Cut-Off Current	I_{BL}	-	50	nA	V_{CE} =30V, V_{EB} =3V
Emitter Cut-Off Current	I_{CEX}	-	50	nA	V_{CE} =30V, V_{BE} =3V
On Characteristics(1)					
DC Current Gain(1)	h_{FE}	40	-		I_C =0.1mA, V_{CE} =1V
		70	-		I_C =1mA, V_{CE}=1V
		100	300		I_C =10mA, V_{CE} =1V
		60	-		I_C =50mA, V_{CE} =1V
		30	-		I_C =100mA, V_{CE} =1V
Collector-Emitter Saturation Voltage[1]	$V_{CE(sat)}$	-	0.2	V	I_C =10mA, I_B =1mA
		-	0.3		I_C =50mA, I_B =5mA
Base-Emitter Saturation Voltage[1]	$V_{BE(sat)}$	0.65	0.85	V	I_C =10mA, I_B =1mA
		-	0.95		I_C =50mA, I_B =5mA
Small-Signal Characteristics					
Current-Gain-Bandwidth Product	f_T	200	-	MHz	V_{CE} =20V, I_C =10mA, f = 100 MHz
Output Capacitance	C_{obo}	-	4	pF	V_{CB} =5V, I_E = 0, f =1MHz
Input Capacitance	C_{ibo}	-	8	pF	V_{BE} =0.5V, I_E = 0, f =1MHz
Input Impedance	h_{ie}	1	10	pF	V_{CE} =10V, I_C =1mA, f =1kHz
Voltage Feedback Ratio	h_{re}	0.5	8	$X10^{-4}$	V_{CE} =10V, I_C =1mA, f =1kHz
Small-Signal Current Gain	h_{fe}	100	400	-	V_{CE} =10V, I_C =1mA, f =1kHz
Output Admittance	$*h_{oe}$	1	40	μmhos	V_{CE} =10V, I_C =1mA, f =1kHz
Noise Figure	NF	-	5	dB	V_{CE} =5V, I_C =100μA, R_S =1.0k Ω, f =1kHz
Switching Characteristics					
Delay Time	T_d	-	35	nS	V_{CC} =3V, V_{BE} =0.5V, I_C =10 mA, I_{B1} =1mA
Rise Time	T_r	-	35	nS	
Storage Time	T_S	-	200	nS	V_{CC} =3V, I_C =10mA, I_{B1} = I_{B2} =1mA
Fall Time	T_F	-	50	nS	

Note:
1. Pulse Test：Pulse Width ≦ 300 μs, Duty Cycle≦ 2.0%.

CHARACTERISTIC CURVES





* Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit

Figure 2. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

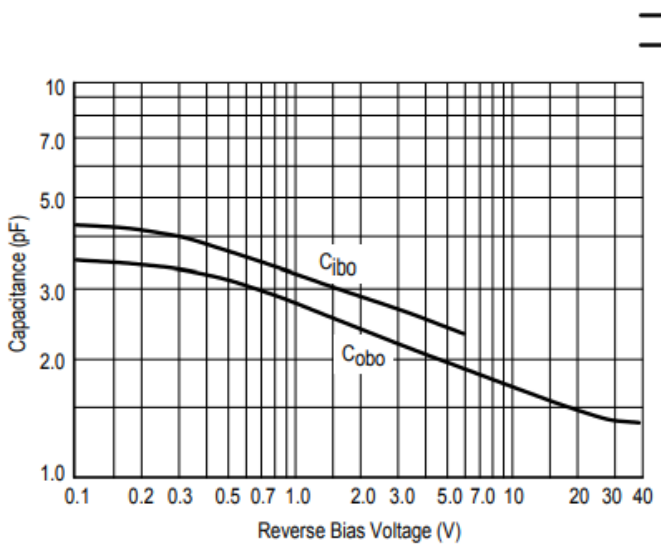


Figure 3. Capacitance

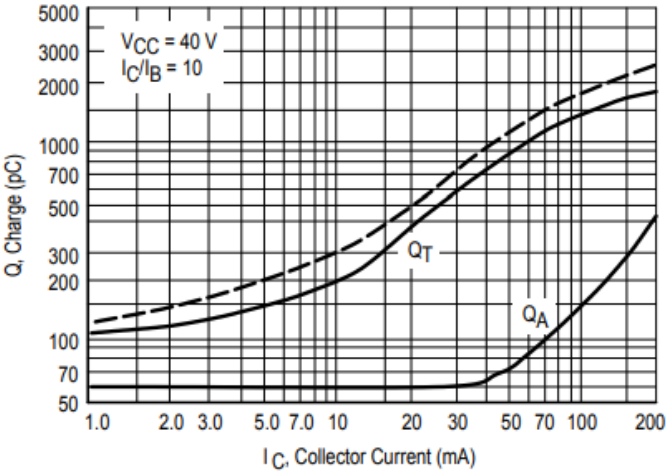


Figure 4. Charge Data

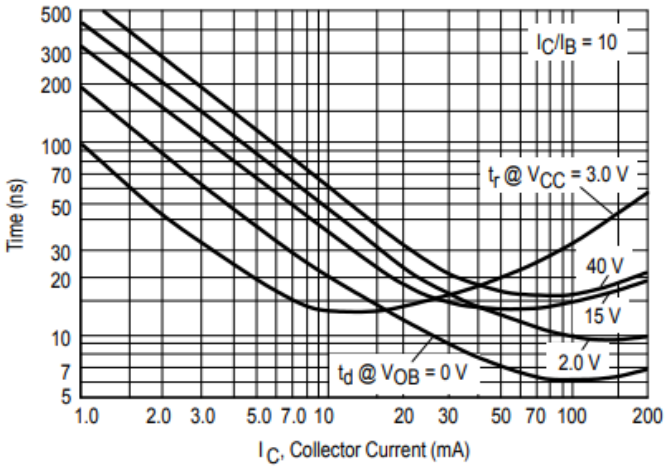


Figure 5. Turn−On Time

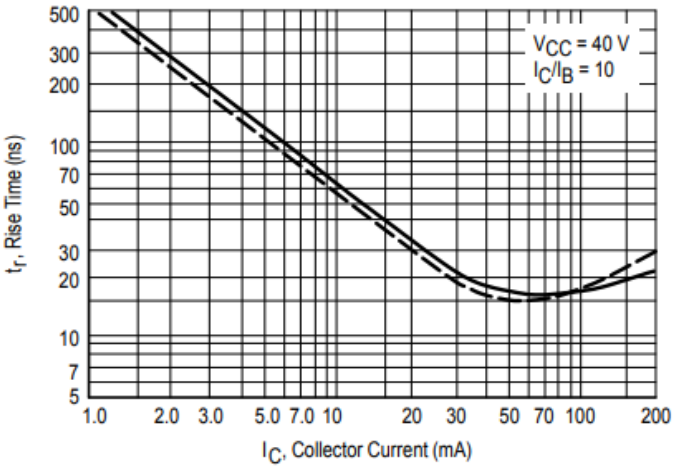


Figure 6. Rise Time

CHARACTERISTIC CURVES

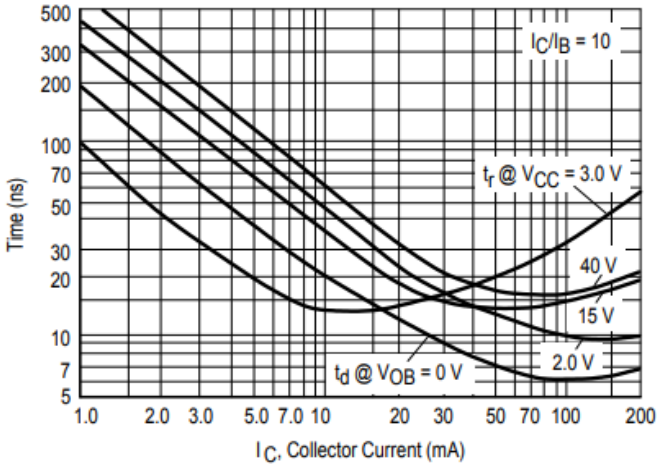


Figure 5. Turn–On Time

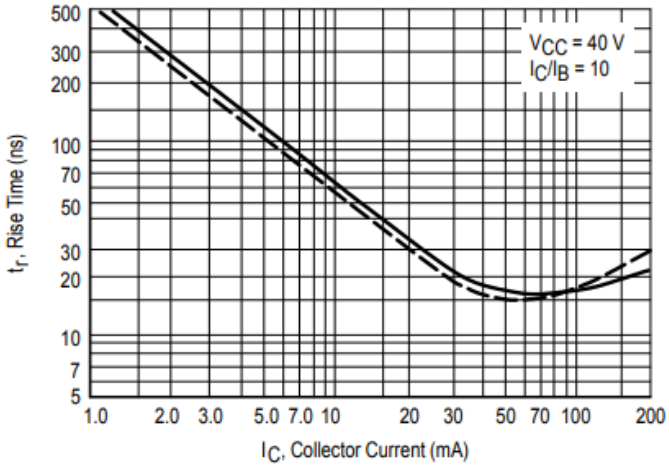


Figure 6. Rise Time

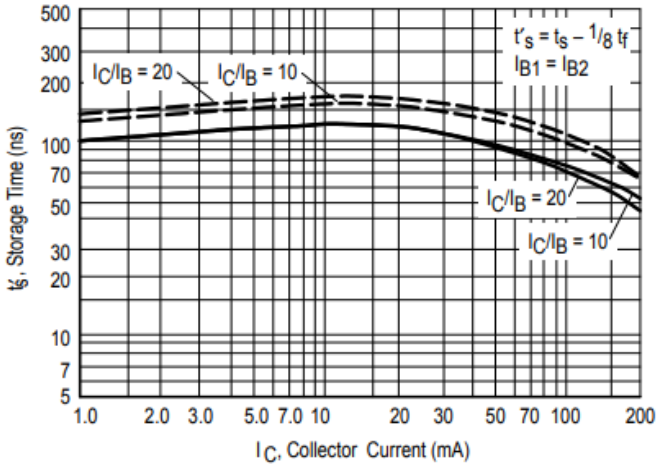


Figure 7. Storage Time

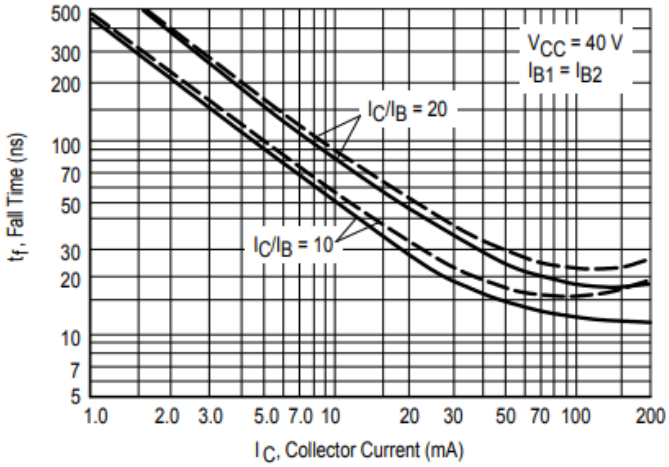


Figure 8. Fall Time

TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS
(V_{CE} = 5.0 Vdc, T_A = 25°C, Bandwidth = 1.0 Hz)

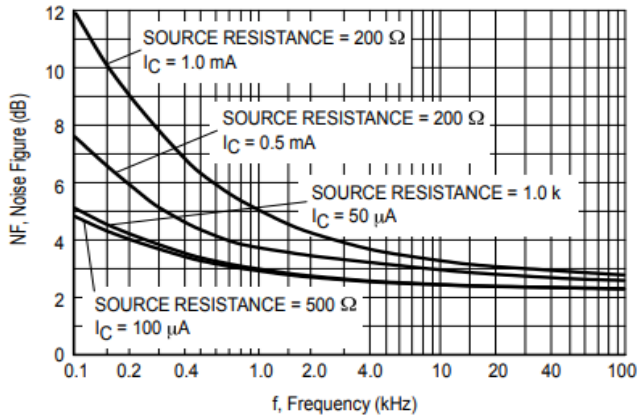


Figure 9.

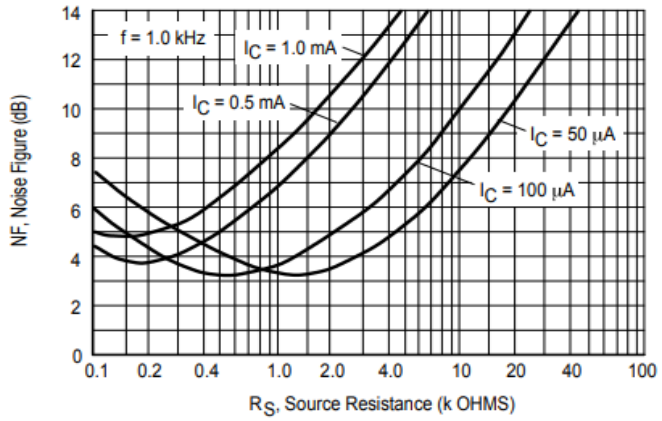


Figure 10.

CHARACTERISTIC CURVES

h PARAMETERS
(V_{CE} = 10 Vdc, f = 1.0 kHz, T_A = 25°C)

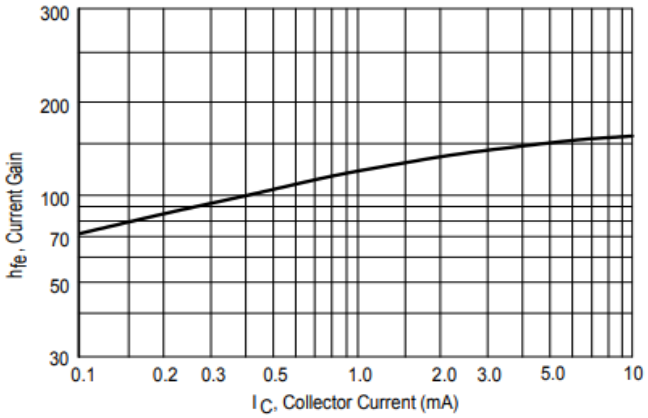


Figure 11. Current Gain

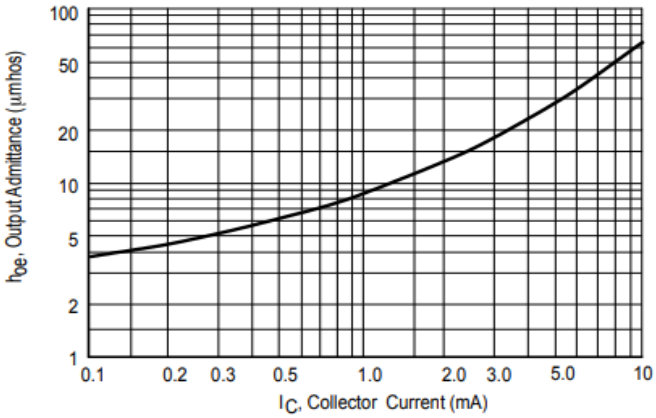


Figure 12. Output Admittance

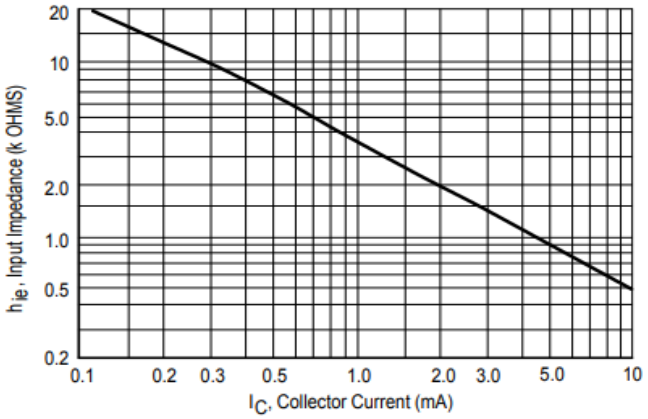


Figure 13. Input Impedance

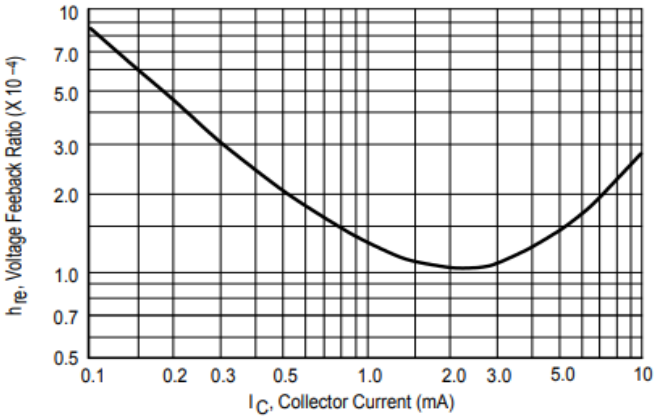


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

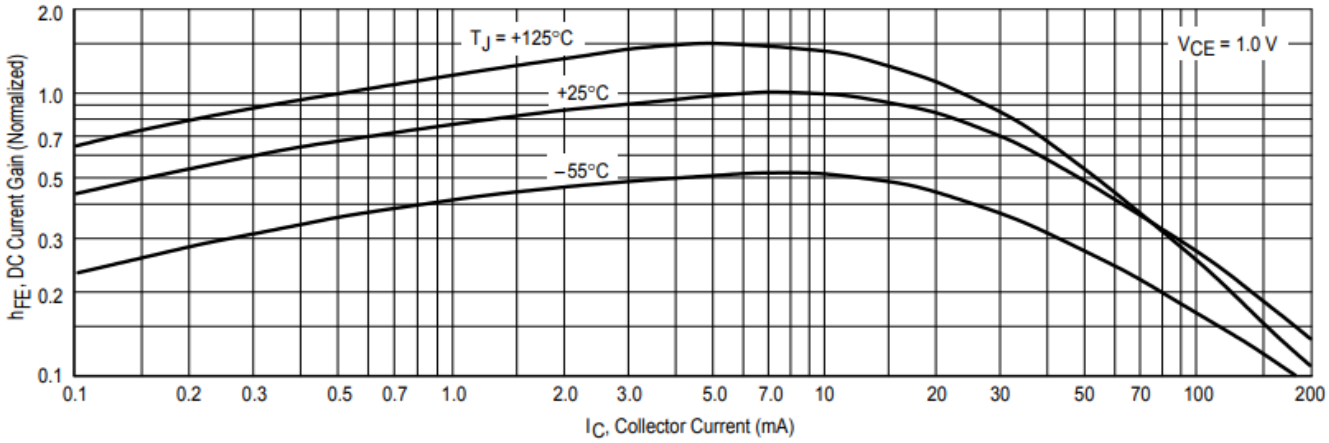


Figure 15. DC Current Gain

CHARACTERISTIC CURVES

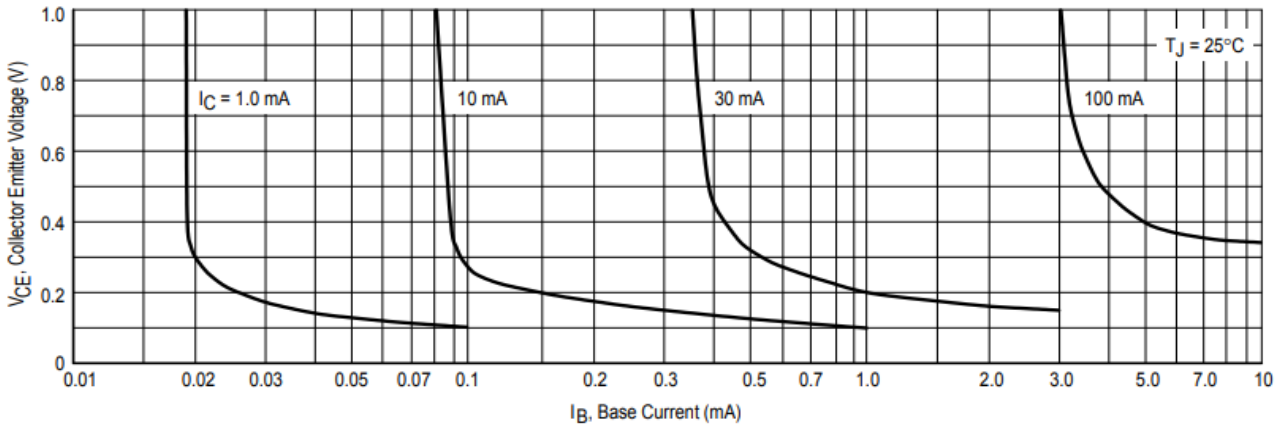


Figure 16. Collector Saturation Region

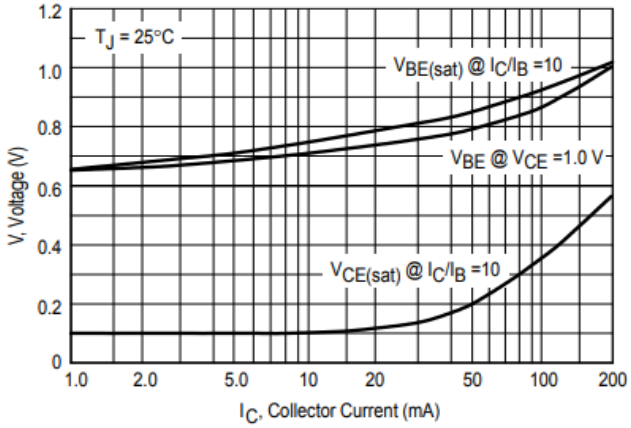


Figure 17. "ON" Voltages

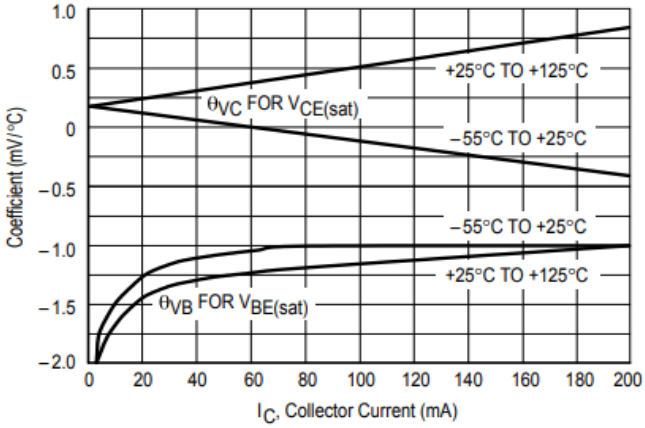


Figure 18. Temperature Coefficients