

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.

MARKING

MA

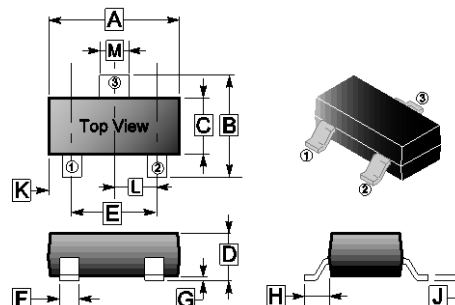
PACKAGE INFORMATION

Package	MPQ	Leader Size
SOT-523	3K	7 inch

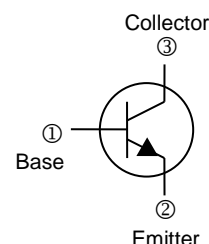
ORDER INFORMATION

Part Number	Type
MMBT3904T-C	Lead (Pb)-free and Halogen-free

SOT-523



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.50	1.70	G	-	0.10
B	1.45	1.75	H	0.55	REF.
C	0.70	0.90	J	0.08	0.20
D	0.60	0.90	K	-	-
E	0.90	1.10	L	0.50	TYP.
F	0.15	0.35	M	0.25	0.40



ABSOLUTE MAXIMUM RATINGS (T_A=25°C unless otherwise specified)

Parameter	Symbol	Ratings	Unit	
Collector-Base Voltage	V _{CB0}	60	V	
Collector-Emitter Voltage	V _{CE0}	40		
Emitter-Base Voltage	V _{EB0}	6		
Collector Current-Continuous	I _c	200	mA	
Total Device Dissipation FR-4 Board ¹	P _D	T _A =25°C	200	mW
		Derate above 25°C	1.6	mW/°C
Thermal Resistance, Junction-Ambient	R _{θJA}	600	°C/W	
Total Device Dissipation FR-4 Board ²	P _D	T _A =25°C	300	mW
		Derate above 25°C	2.4	mW/°C
Thermal Resistance, Junction-Ambient	R _{θJA}	400	°C/W	
Junction & Storage Temperature Range	T _J , T _{STG}	-55~150	°C	

ELECTRICAL CHARACTERISTICS ($T_A=25^\circ\text{C}$ unless otherwise specified)

Characteristic	Symbol	Min.	Max.	Unit	Test Conditions
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60	-	V	$I_C=10\mu\text{A}$
Collector-Emitter Breakdown Voltage ³	$V_{(BR)CEO}$	40	-		$I_C=1\text{mA}$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	6.0	-		$I_E=10\mu\text{A}$
Collector Cut-Off Current	I_{BL}	-	50	nA	$V_{CE}=30\text{V}, V_{EB}=3\text{V}$
Emitter Cut-Off Current	I_{CEX}	-	50	nA	$V_{CE}=30\text{V}, V_{BE}=3\text{V}$
DC Current Gain ³	h_{FE}	40	-		$I_C=0.1\text{mA}, V_{CE}=1\text{V}$
		70	-		$I_C=1\text{mA}, V_{CE}=1\text{V}$
		100	300		$I_C=10\text{mA}, V_{CE}=1\text{V}$
		60	-		$I_C=50\text{mA}, V_{CE}=1\text{V}$
		30	-		$I_C=100\text{mA}, V_{CE}=1\text{V}$
Collector-Emitter Saturation Voltage ³	$V_{CE(sat)}$	-	0.2	V	$I_C=10\text{mA}, I_B=1\text{mA}$
		-	0.3		$I_C=50\text{mA}, I_B=5\text{mA}$
Base-Emitter Saturation Voltage ³	$V_{BE(sat)}$	0.65	0.85	V	$I_C=10\text{mA}, I_B=1\text{mA}$
		-	0.95		$I_C=50\text{mA}, I_B=5\text{mA}$
Current-Gain-Bandwidth Product	f_T	200	-	MHz	$V_{CE}=20\text{V}, I_C=10\text{mA}, f=100\text{MHz}$
Output Capacitance	C_{obo}	-	4.0	pF	$V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$
Input Capacitance	C_{ibo}	-	8.0	pF	$V_{BE}=0.5\text{V}, I_E=0, f=1\text{MHz}$
Input Impedance	h_{ie}	1.0	10	pF	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Voltage Feedback Ratio	h_{re}	0.5	8.0	$\times 10^{-4}$	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Small-Signal Current Gain	h_{fe}	100	400	-	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Output Admittance	h_{oe}	1.0	40	μmhos	$V_{CE}=10\text{V}, I_C=1\text{mA}, f=1\text{kHz}$
Noise Figure	NF	-	5.0	dB	$V_{CE}=5\text{V}, I_C=100\mu\text{A}, R_S=1\text{k}\Omega, f=1\text{kHz}$
Delay Time	T_d	-	35	nS	$V_{CC}=3\text{V}, V_{BE}=0.5\text{V}, I_C=10\text{mA}, I_{B1}=1\text{mA}$
Rise Time	T_r	-	35		
Storage Time	T_s	-	200	nS	$V_{CC}=3\text{V}, I_C=10\text{mA}, I_{B1}=I_{B2}=1\text{mA}$
Fall Time	T_f	-	50		

Notes:

- FR-4 Minimum Pad.
- FR-4 1.0 X 1.0 Inch Pad.
- Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

CHARACTERISTIC CURVES

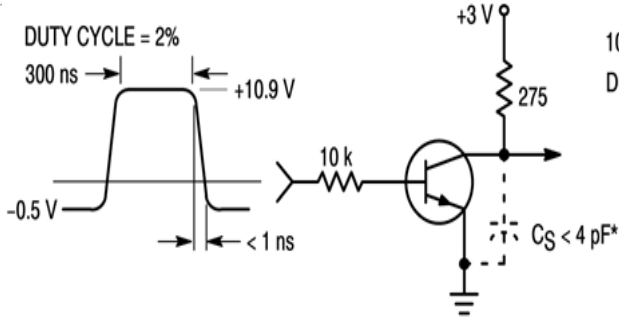


Figure 1. Delay and Rise Time Equivalent Test Circuit

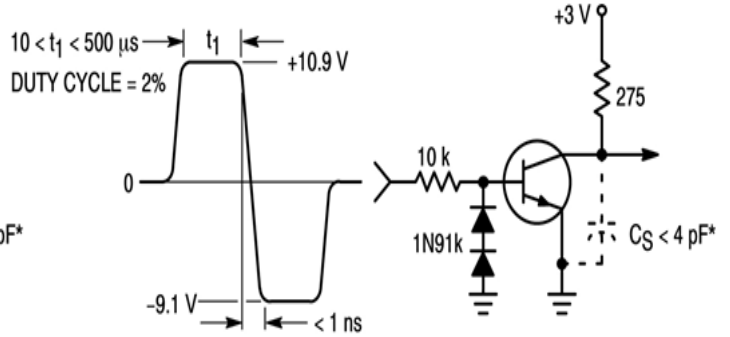


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

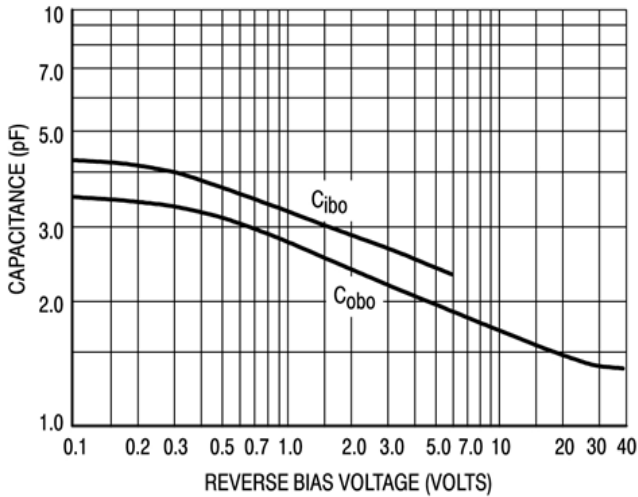


Figure 3. Capacitance

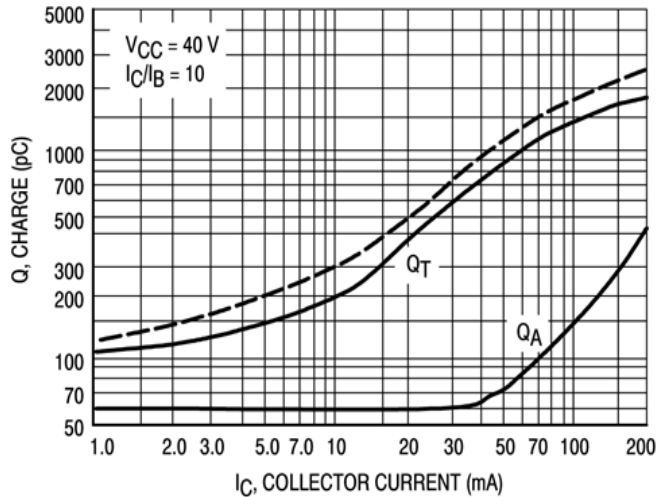


Figure 4. Charge Data

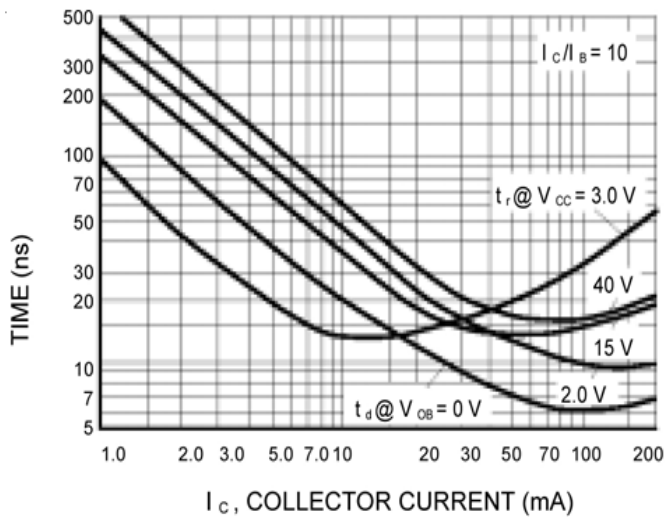


Figure 5. Turn-On Time

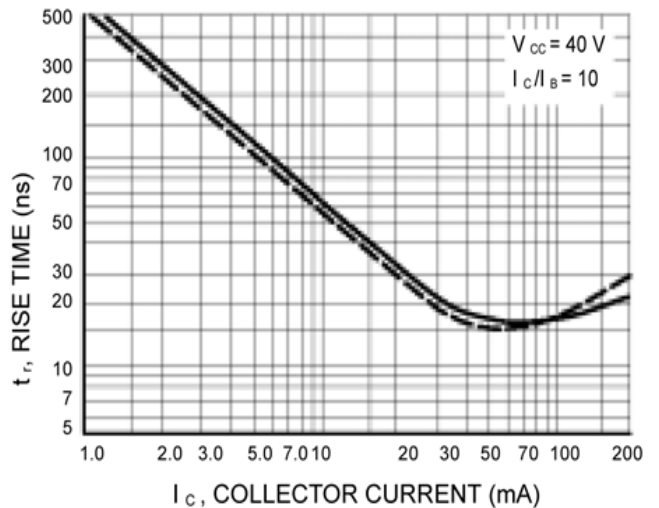


Figure 6. Rise Time

CHARACTERISTIC CURVES

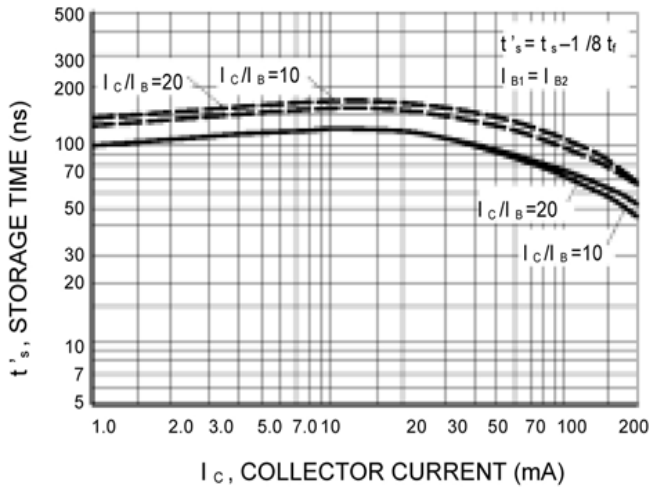


Figure 7. Storage Time

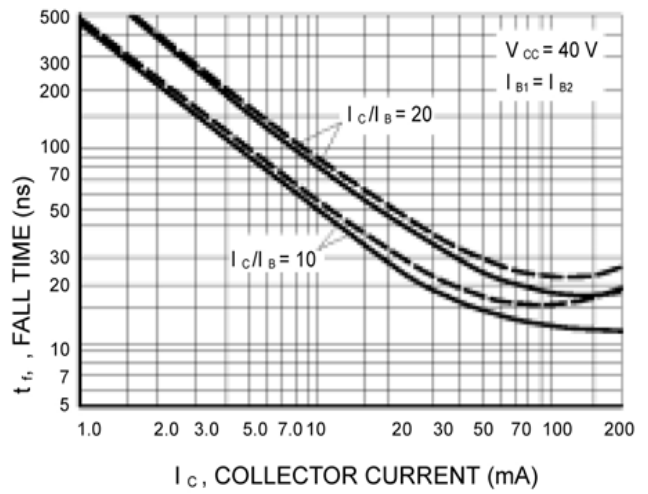


Figure 8. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

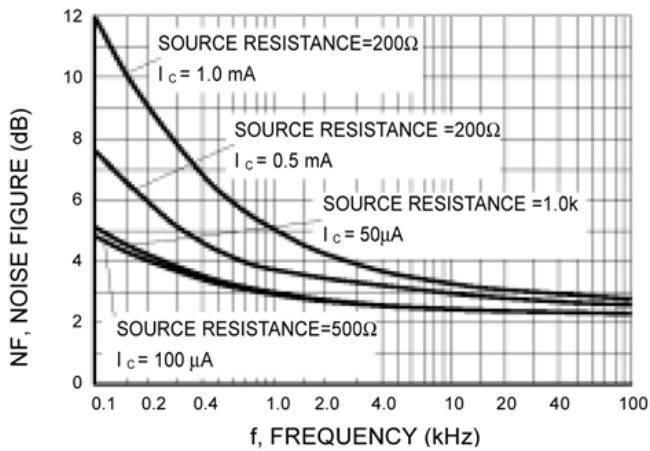


Figure 9. Noise Figure

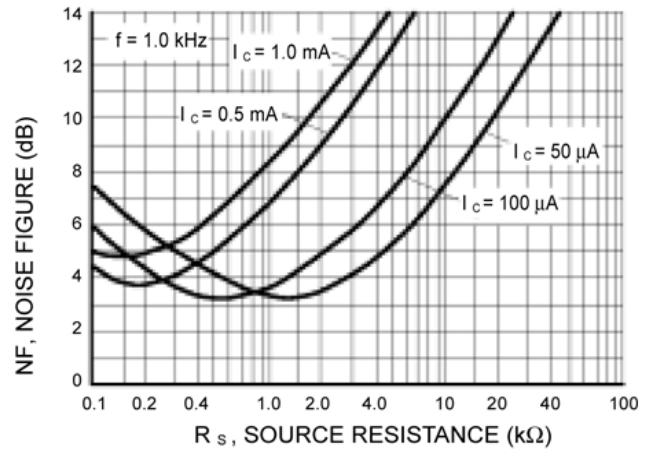


Figure 10. Noise Figure

h PARAMETERS

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

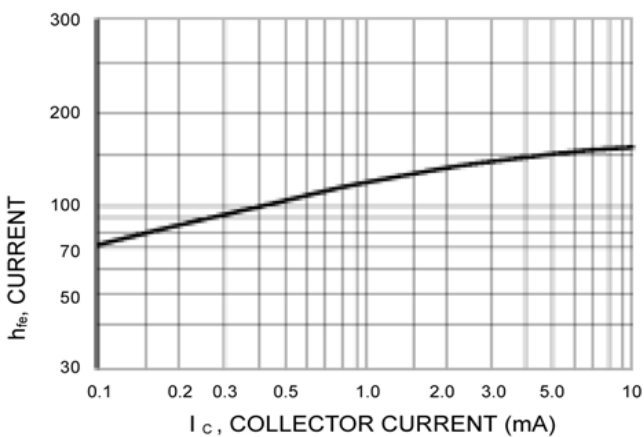


Figure 11. Current Gain

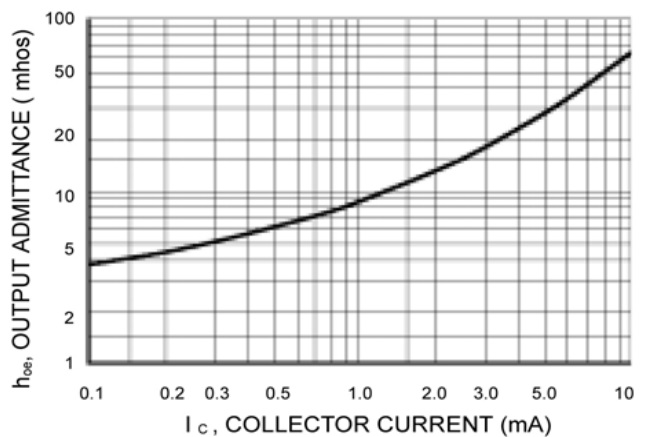


Figure 12. Output Admittance

CHARACTERISTIC CURVES

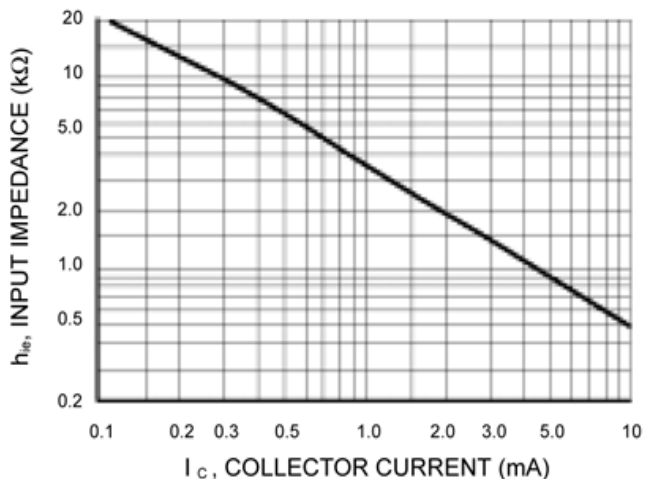


Figure 13. Input Impedance

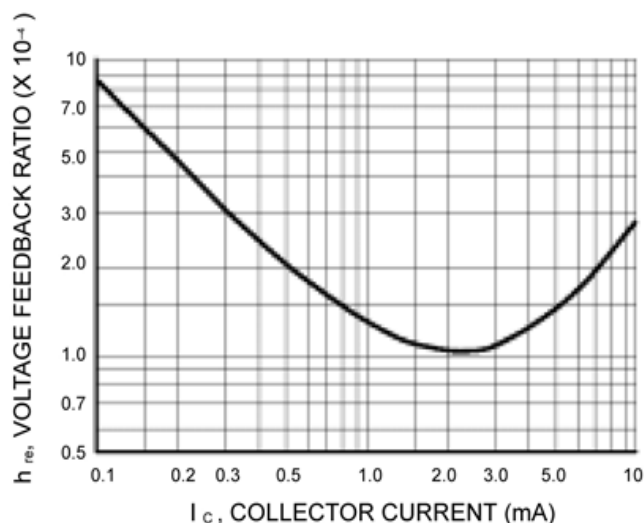


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

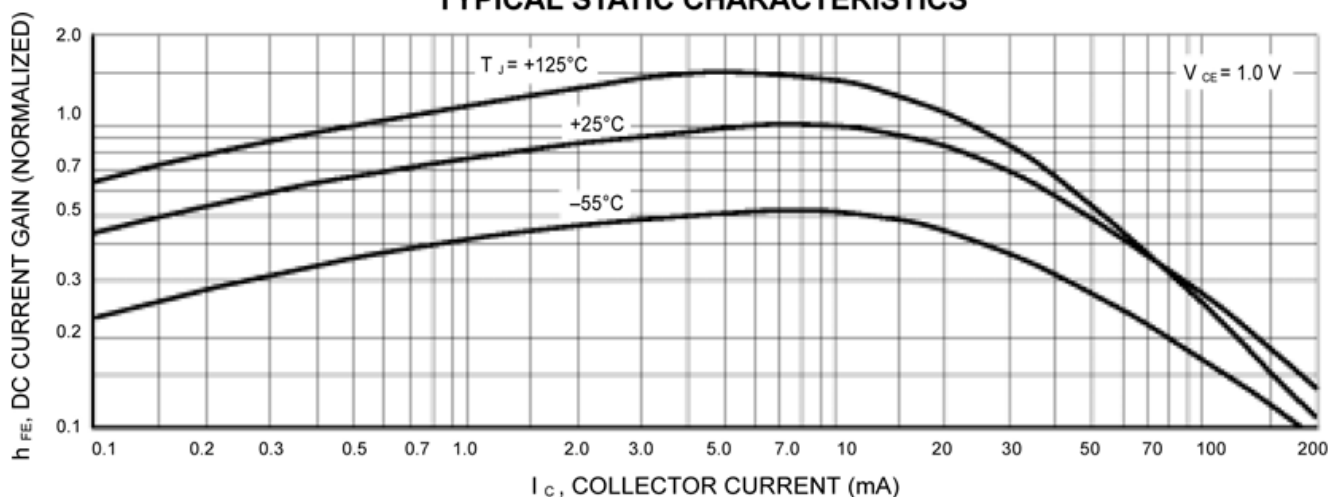


Figure 15. DC Current Gain

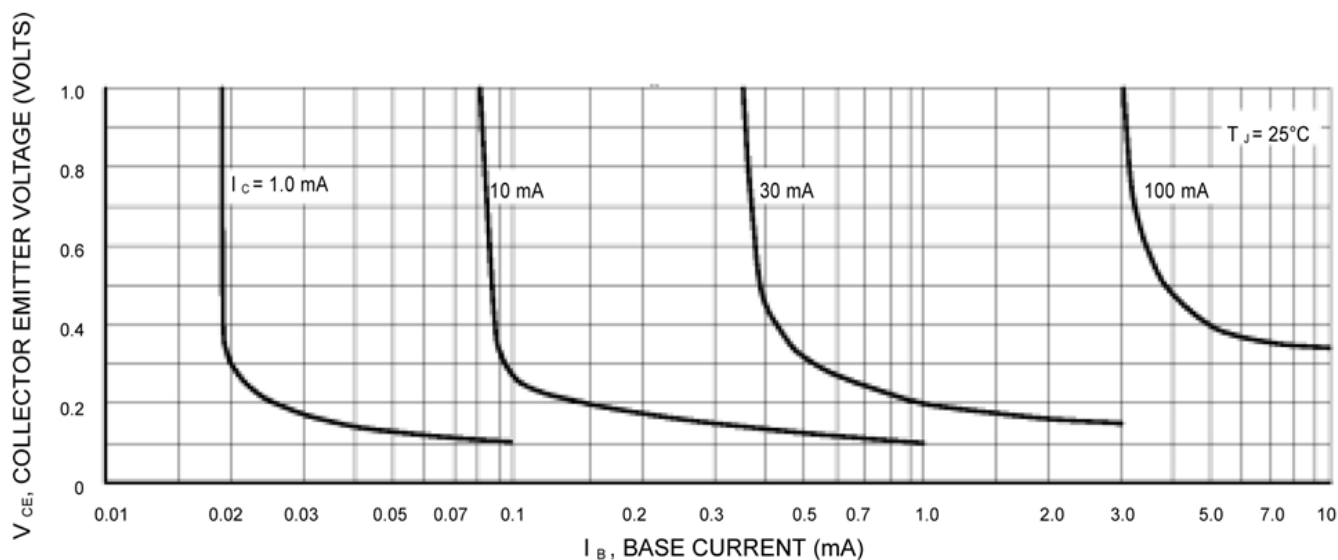


Figure 16. Collector Saturation Region

CHARACTERISTIC CURVES

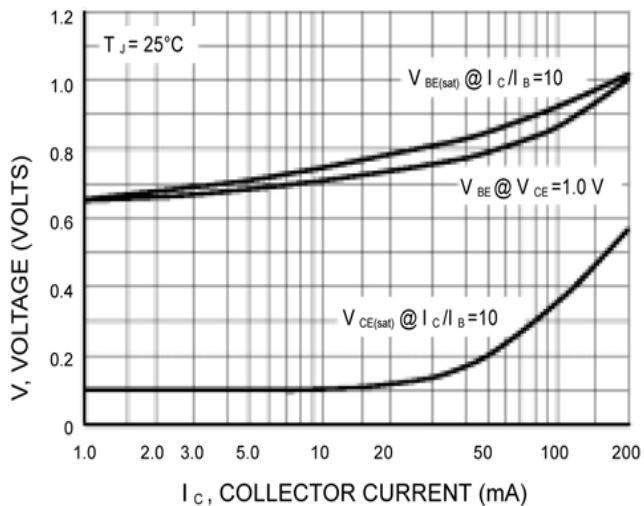


Figure 17. "ON" Voltages

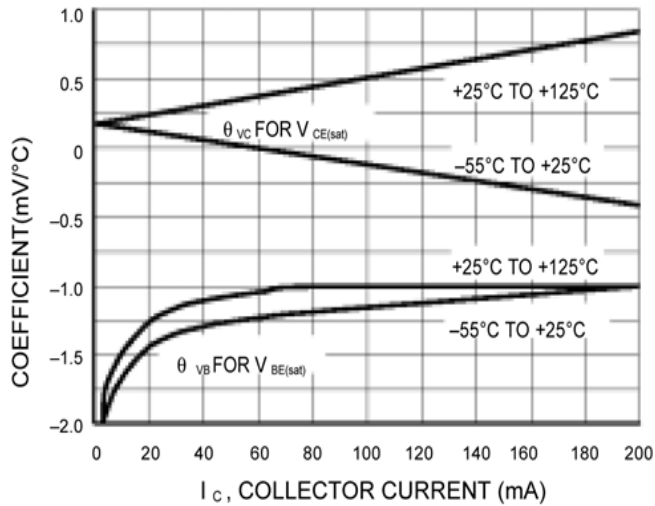


Figure 18. Temperature Coefficients

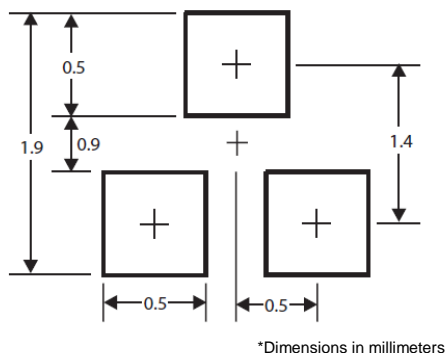


Figure 19. Mounting Pad Layout