

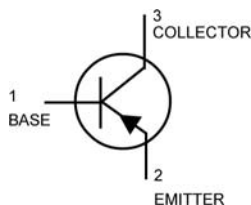
RoHS Compliant Product  
A suffix of "-C" specifies halogen & lead-free

## FEATURES

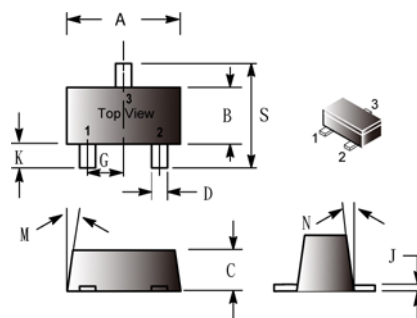
- Simplifies Circuit Design.
- We Declare that the material of product compliance with RoHS requirements.

## ORDERING INFORMATION

Device	Marking	Shipping
MMBT3906T	2A	3000/Tape&Reel



## SOT-523



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.50	1.70	K	0.30	0.50
B	0.75	0.95	M	---	10°
C	0.60	0.80	N	---	10°
D	0.23	0.33	S	1.50	1.70
G	0.50BSC				
J	0.10	0.20			

## MAXIMUM RATINGS (at $T_a = 25^\circ\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector - Emitter Voltage	$V_{CEO}$	-40	Vdc
Collector - Base Voltage	$V_{CBO}$	-40	Vdc
Emitter - Base Voltage	$V_{EBO}$	-5.0	Vdc
Collector Current - Continuous	$I_C$	-200	mAdc
Total Device Dissipation FR-4 Board <sup>(1)</sup> $T_A=25^\circ\text{C}$ , Derate above $25^\circ\text{C}$	$P_D$	200	mW
		1.6	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	600	$^\circ\text{C} / \text{W}$
Total Device Dissipation FR-4 Board <sup>(2)</sup> $T_A=25^\circ\text{C}$ , Derate above $25^\circ\text{C}$	$P_D$	300	mW
		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	400	$^\circ\text{C} / \text{W}$
Junction & Storage Temperature	$T_J, T_{STG}$	-55 ~ 150	$^\circ\text{C}$

1. FR-4 Minimum Pad.
2. FR-4 1.0 X 1.0 Inch Pad.
3. Pulse Test : Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## DEVICE MARKING

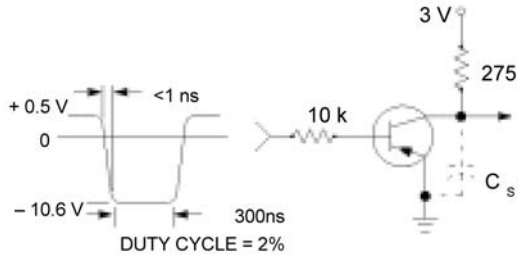
MMBT3906T = 2A

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

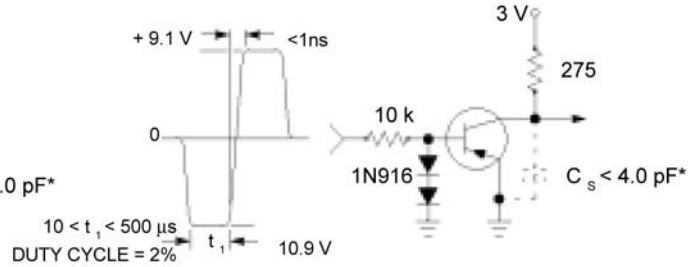
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT	TEST CONDITIONS
<b>Off Characteristics</b>					
Collector-Emitter Breakdown Voltage <sup>(3)</sup>	$V_{(BR)CEO}$	-40	-	Vdc	$I_C = -1.0 \text{ mAdc}, I_B = 0$
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-40	-	Vdc	$I_C = -10 \mu\text{Adc}, I_E = 0$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-5.0	-	Vdc	$I_E = -10 \mu\text{Adc}, I_C = 0$
Collector Cut-Off Current	$I_{BL}$	-	-50	nAdc	$V_{CE} = -30 \text{ Vdc}, V_{EB} = -3.0 \text{ Vdc}$
Emitter Cut-Off Current	$I_{CEX}$	-	-50	nAdc	$V_{CE} = -30 \text{ Vdc}, V_{BE} = -3.0 \text{ Vdc}$
<b>On Characteristics<sup>(3)</sup></b>					
DC Current Gain <sup>(1)</sup>	$h_{FE}$	60	-	-	$I_C = -0.1 \text{ mAdc}, V_{CE} = -1.0 \text{ Vdc}$
		80	-		$I_C = -1.0 \text{ mAdc}, V_{CE} = -1.0 \text{ Vdc}$
		100	300		$I_C = -10 \text{ mAdc}, V_{CE} = -1.0 \text{ Vdc}$
		60	-		$I_C = -50 \text{ mAdc}, V_{CE} = -1.0 \text{ Vdc}$
		30	-		$I_C = -100 \text{ mAdc}, V_{CE} = -1.0 \text{ Vdc}$
Collector-Emitter Saturation Voltage <sup>(3)</sup>	$V_{CE(sat)}$	-	-0.25	Vdc	$I_C = -10 \text{ mAdc}, I_B = -1.0 \text{ mAdc}$
		-	-0.4		$I_C = -50 \text{ mAdc}, I_B = -5.0 \text{ mAdc}$
Base-Emitter Saturation Voltage <sup>(3)</sup>	$V_{BE(sat)}$	-0.65	-0.85	Vdc	$I_C = -10 \text{ mAdc}, I_B = -1.0 \text{ mAdc}$
		-	-0.95		$I_C = -50 \text{ mAdc}, I_B = -5.0 \text{ mAdc}$
<b>Small-Signal Characteristics</b>					
Curren-Gain-Bandwidth Product	$f_T$	250	-	MHz	$V_{CE} = -20 \text{ Vdc}, I_C = -10 \text{ mAdc}, f = 100 \text{ MHz}$
Output Capacitance	$C_{obo}$	-	4.5	pF	$V_{CB} = -5.0 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$
Input Capacitance	$C_{ibo}$	-	10	pF	$V_{BE} = -0.5 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$
Input Impedancen	$h_{ie}$	2.0	12	pF	$V_{CE} = -10 \text{ Vdc}, I_C = -1.0 \text{ mAdc}, f = 1.0 \text{ kHz}$
Voltage Feedback Ratio	$h_{re}$	0.1	10	$\times 10^{-4}$	$V_{CE} = -10 \text{ Vdc}, I_C = -1.0 \text{ mAdc}, f = 1.0 \text{ kHz}$
Small-Signal Current Gain	$h_{fe}$	100	400	-	$V_{CE} = -10 \text{ Vdc}, I_C = -1.0 \text{ mAdc}, f = 1.0 \text{ kHz}$
Output Admittance	$*h_{oe}$	3.0	60	$\mu\text{mhos}$	$V_{CE} = -10 \text{ Vdc}, I_C = -1.0 \text{ mAdc}, f = 1.0 \text{ kHz}$
Noise Figure	NF	-	4.0	dB	$V_{CE} = -5.0 \text{ Vdc}, I_C = -100 \mu\text{Adc}, R_S = 1.0 \text{ k}\Omega, f = 1.0 \text{ kHz}$
<b>Switching Characteristics</b>					
Delay Time	$T_d$	-	35	nS	$V_{CC} = -3.0 \text{ Vdc}, V_{BE} = 0.5 \text{ Vdc}, I_C = -10 \text{ mAdc}, I_{B1} = -1.0 \text{ mAdc}$
Rise Time	$T_r$	-	35	nS	
Storage Time	$T_S$	-	225	nS	$V_{CC} = -3.0 \text{ Vdc}, I_C = -10 \text{ mAdc}, I_{B1} = I_{B2} = -1.0 \text{ mAdc}$
Fall Time	$T_F$	-	75	nS	

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

**CHARACTERISTIC CURVES**



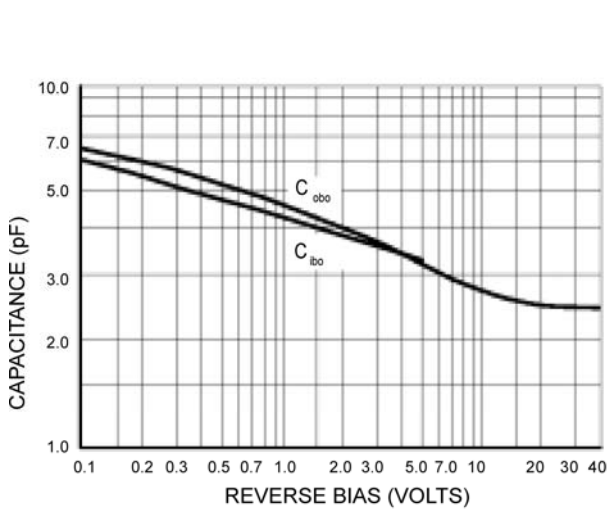
**Figure 1. Delay and Rise Time  
Equivalent Test Circuit**



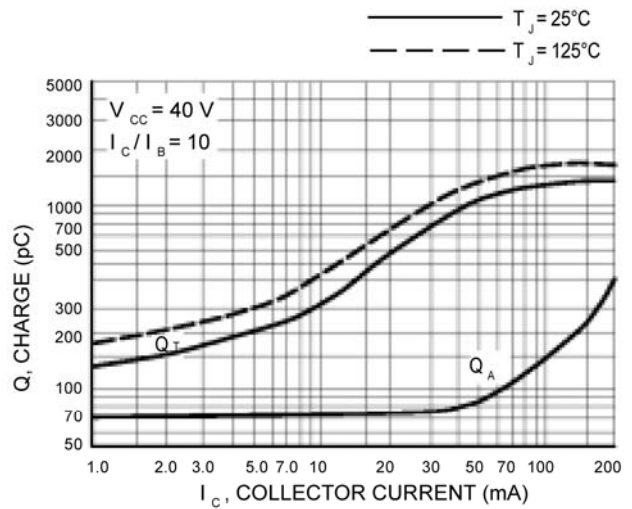
**Figure 2. Storage and Fall Time  
Equivalent Test Circuit**

\*Total shunt capacitance of test jig and connectors

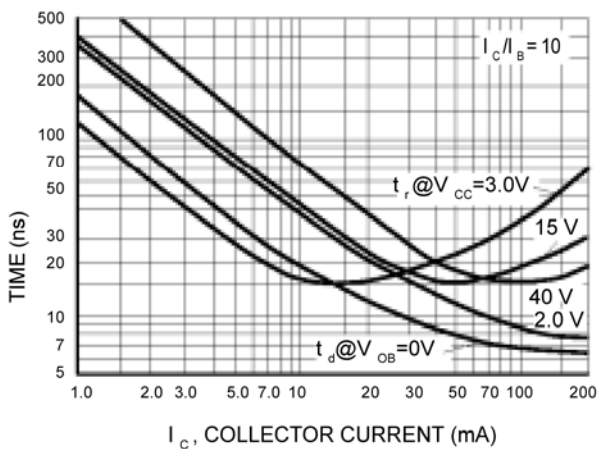
**TYPICAL TRANSIENT CHARACTERISTICS**



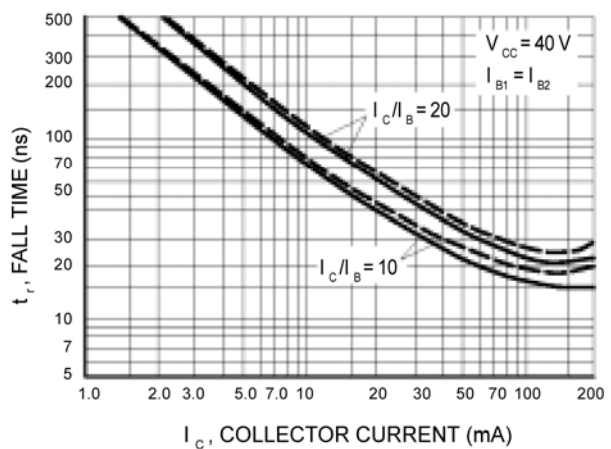
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**

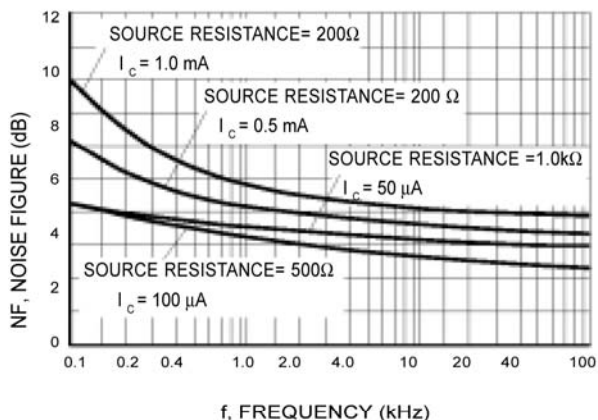


**Figure 6. Fall Time**

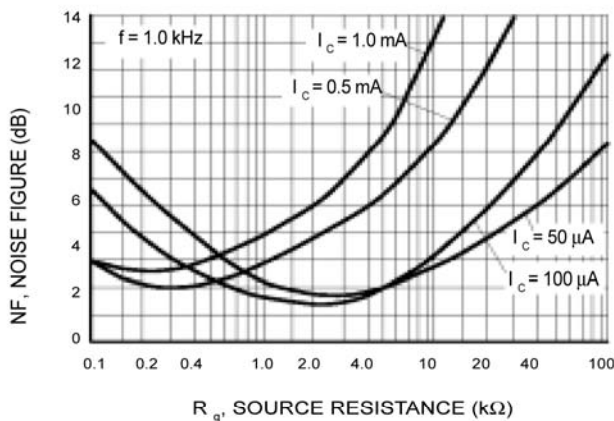
**CHARACTERISTIC CURVES**

**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS  
NOISE FIGURE VARIATIONS**

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



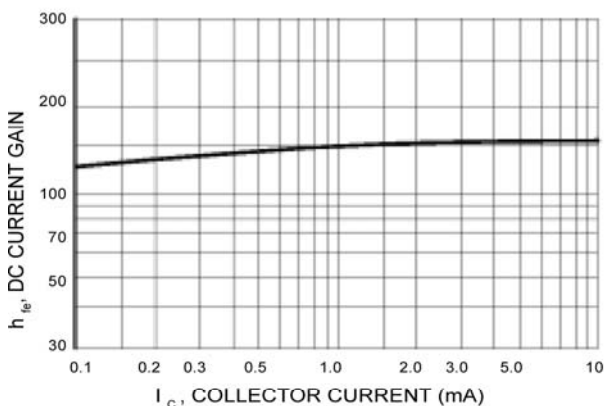
**Figure 7. Noise Figure**



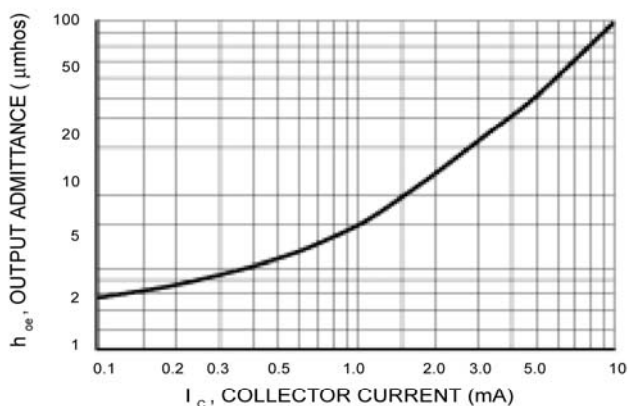
**Figure 8. Noise Figure**

**h PARAMETERS**

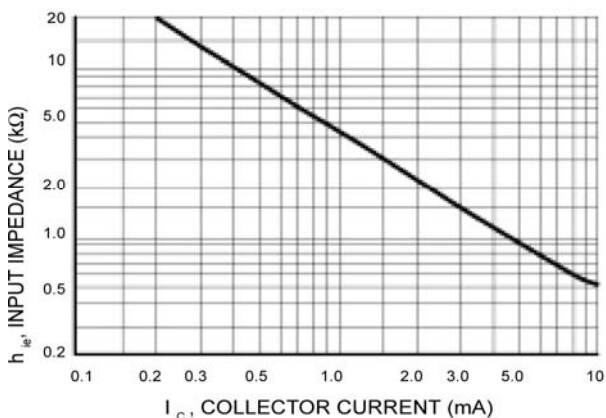
( $V_{CE} = 10$  Vdc,  $f = 1.0$  kHz,  $T_A = 25^\circ\text{C}$ )



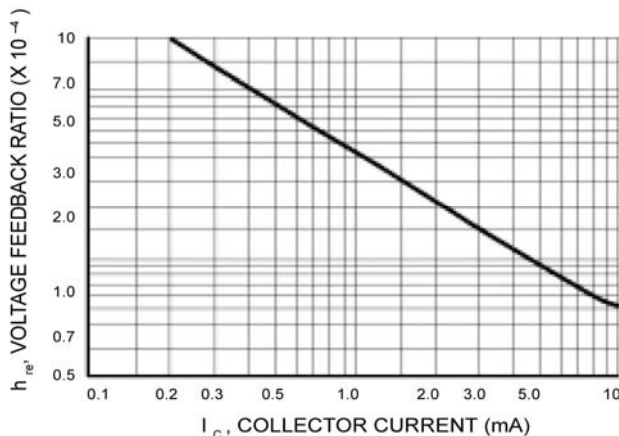
**Figure 9. Current Gain**



**Figure 10. Output Admittance**



**Figure 11. Input Impedance**



**Figure 12. Voltage Feedback Ratio**

**CHARACTERISTIC CURVES**

**TYPICAL STATIC CHARACTERISTICS**

