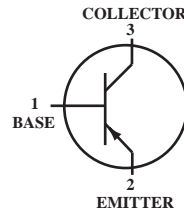


### General Purpose Transistor PNP Silicon

 Lead(Pb)-Free



**SC-89  
(SOT-523F)**

### Maximum Ratings

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	-40	V
Collector-Base Voltage	$V_{CBO}$	-40	V
Emitter-Base Voltage	$V_{EBO}$	-5.0	V
Collector Current-Continuous	$I_C$	-200	mA

### Thermal Characteristics

Characteristics	Symbol	Max	Unit
Total Device Dissipation FR-5 Board <sup>(1)</sup> $T_A=25^{\circ}\text{C}$ Derate above $25^{\circ}\text{C}$	$P_D$	200	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	600	$^{\circ}\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, <sup>(2)</sup> $T_A=25^{\circ}\text{C}$ Derate above $25^{\circ}\text{C}$	$P_D$	300	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	400	$^{\circ}\text{C}/\text{W}$
Junction Temperature	$T_J$	-55 to +150	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^{\circ}\text{C}$

### Device Marking

MMBT3906T = 2A

### Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ Unless Otherwise noted)

Characteristics	Symbol	Min	Max	Unit
-----------------	--------	-----	-----	------

### Off Characteristics

Collector-Emitter Breakdown Voltage <sup>(3)</sup> ( $I_C=-1.0\text{mA}$ , $I_B=0$ )	$V_{(BR)CEO}$	-40	-	V
Collector-Base Breakdown Voltage ( $I_C=-10\ \mu\text{A}$ , $I_E=0$ )	$V_{(BR)CBO}$	-40	-	V
Emitter-Base Breakdown Voltage ( $I_E=-10\ \mu\text{A}$ , $I_C=0$ )	$V_{(BR)EBO}$	-5.0	-	V
Base Cutoff Current ( $V_{CE}=-30\ \text{Vdc}$ , $V_{EB}=-3.0\ \text{Vdc}$ )	$I_{BL}$	-	-50	nA
Collector Cutoff Current ( $V_{CE}=-30\ \text{Vdc}$ , $V_{EB}=-3.0\ \text{Vdc}$ )	$I_{CEX}$	-	-50	nA

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  $\leq 2.0\%$ .

## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted) (Continued)

Characteristics	Symbol	Min	Max	Unit
-----------------	--------	-----	-----	------

### On Characteristics (3)

DC Current Gain (I <sub>C</sub> = -0.1 mA , V <sub>CE</sub> = -1.0V) (I <sub>C</sub> = -1.0 mA , V <sub>CE</sub> = -1.0 V) (I <sub>C</sub> = -10 mA , V <sub>CE</sub> = -1.0V) (I <sub>C</sub> = -50 mA , V <sub>CE</sub> = -1.0V) (I <sub>C</sub> = -100 mA , V <sub>CE</sub> = -1.0V)	H <sub>FE</sub>	60 80 100 60 30	- - 300 - -	-
Collector-Emitter Saturation Voltage (I <sub>C</sub> = -10 mA , I <sub>B</sub> = -1.0mA) (I <sub>C</sub> = -50 mA , I <sub>B</sub> = -5.0mA)	V <sub>CE(sat)</sub>	- -	-0.25 -0.4	V
Base-Emitter Saturation Voltage (I <sub>C</sub> = -10 mA , I <sub>B</sub> = -1.0 mA) (I <sub>C</sub> = -50 mA , I <sub>B</sub> = -5.0 mA)	V <sub>BE(sat)</sub>	-0.65 -	-0.85 -0.95	V

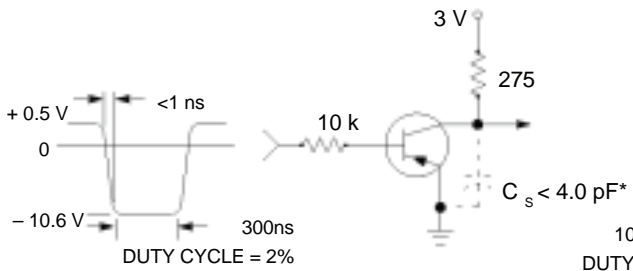
### Small-signal Characteristics

Current-Gain-Bandwidth Product (4) (I <sub>C</sub> = -10 mA , V <sub>CE</sub> = -20 V , f=100MHz)	f <sub>T</sub>	250	-	MHz
Output Capacitance (V <sub>CB</sub> = -5.0 V , I <sub>E</sub> =0, f=1.0MHz)	C <sub>obo</sub>	-	4.5	pF
Input Capacitance (V <sub>EB</sub> = -0.5 V , I <sub>C</sub> =0, f=1.0MHz)	C <sub>ibo</sub>	-	10	pF
Input Impedance (V <sub>CE</sub> = -10V , I <sub>C</sub> =-1.0 mA , f=1.0 kHz)	h <sub>ie</sub>	2.0	12	kΩ
Voltage Feedback Ratio (V <sub>CE</sub> = -10V , I <sub>C</sub> =-1.0 mA , f=1.0 kHz)	h <sub>re</sub>	0.1	10	x 10 <sup>-4</sup>
Small-Signal Current Gain (V <sub>CE</sub> = -10V , I <sub>C</sub> =-1.0 mA , f=1.0 kHz)	h <sub>fe</sub>	100	400	-
Output Admittance (V <sub>CE</sub> = -10V , I <sub>C</sub> =-1.0 mA , f=1.0kHz)	h <sub>oe</sub>	3.0	60	μmhos
Noise Figure (V <sub>CE</sub> = -5.0V , I <sub>C</sub> = -100 μA , R <sub>S</sub> =1.0kΩ , f=1.0kHz)	NF	-	4.0	dB

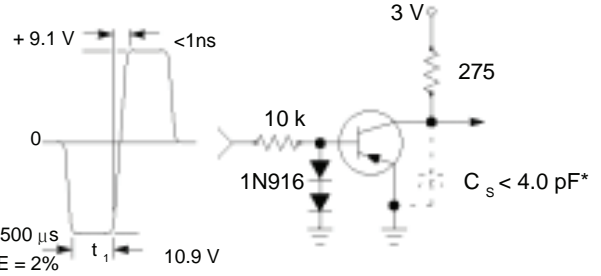
### Switching Characteristics

Delay Time	(V <sub>CC</sub> = -3.0 V , V <sub>BE</sub> = 0.5 V I <sub>C</sub> = -10 mA , I <sub>B1</sub> = -1.0 mA)	t <sub>d</sub>	-	35	ns
Rise Time		t <sub>r</sub>	-	35	
Storage Time	(V <sub>CC</sub> = -3.0 V, I <sub>C</sub> = -10 mA , I <sub>B1</sub> =I <sub>B2</sub> = -1.0 mA)	t <sub>s</sub>	-	225	ns
Fall Time		t <sub>f</sub>	-	75	

3.Pulse Test:Pulse Width≤300 μS, Duty Cycle≤2.0%.



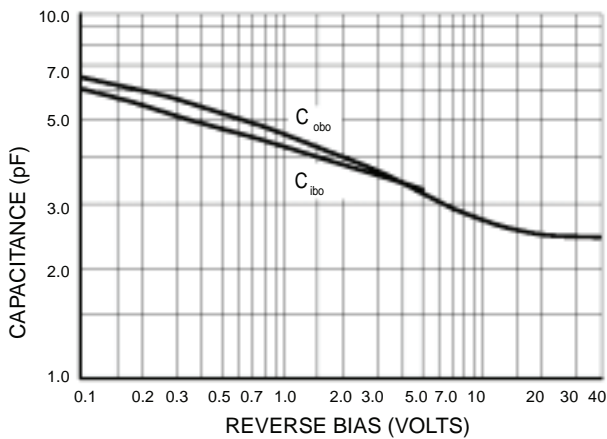
**Figure 1. Delay and Rise Time Equivalent Test Circuit**



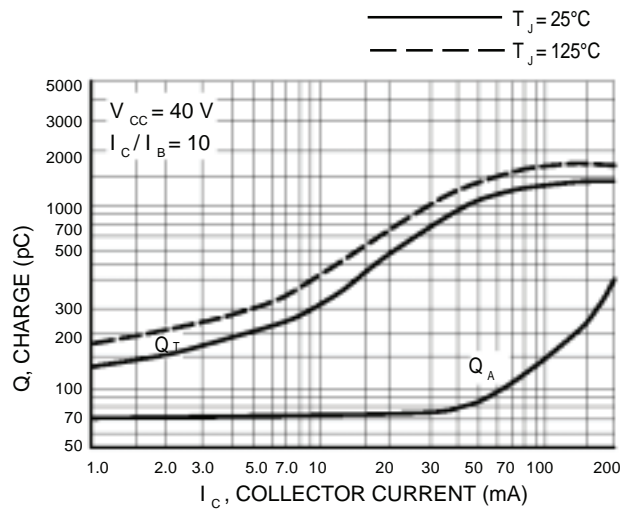
**Figure 2. Storage and Fall Time Equivalent Test Circuit**

\*Total shunt capacitance of test jig and connectors

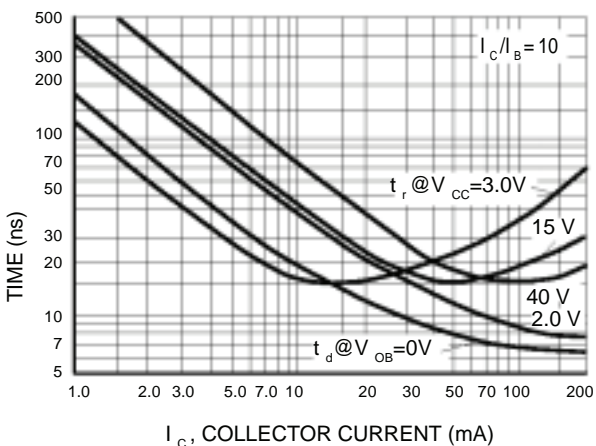
## TYPICAL TRANSIENT CHARACTERISTICS



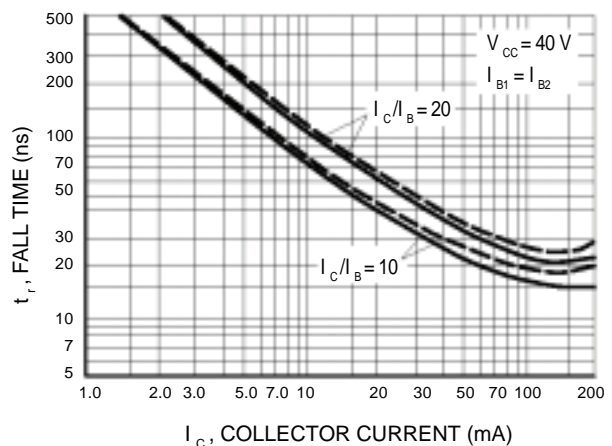
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. Fall Time**

## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

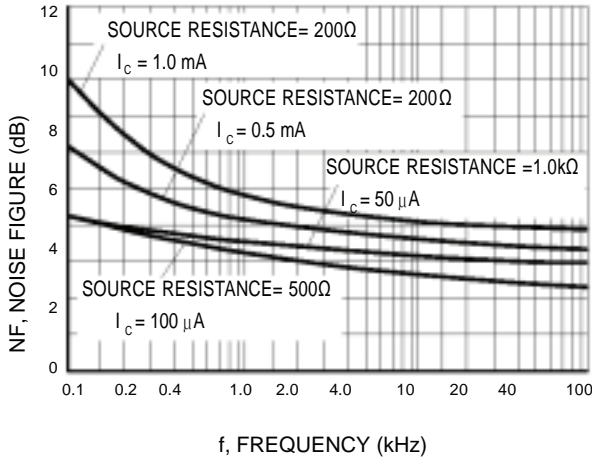


Figure 7. Noise Figure

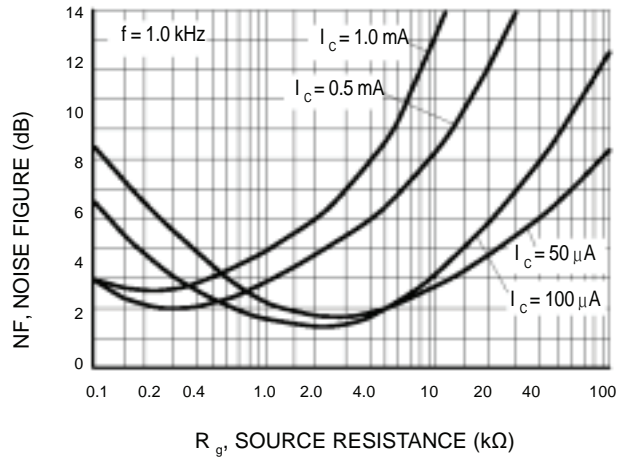


Figure 8. Noise Figure

## h PARAMETERS

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

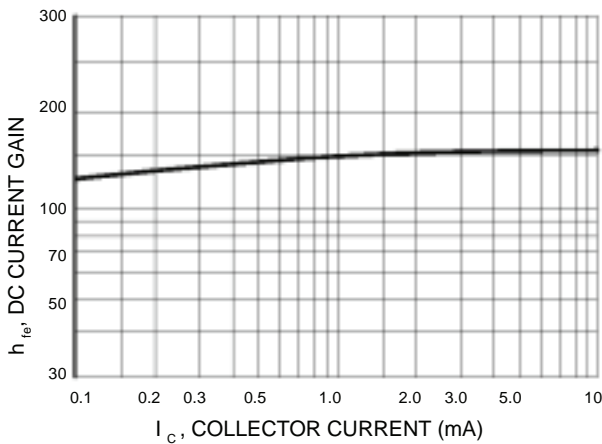


Figure 9. Current Gain

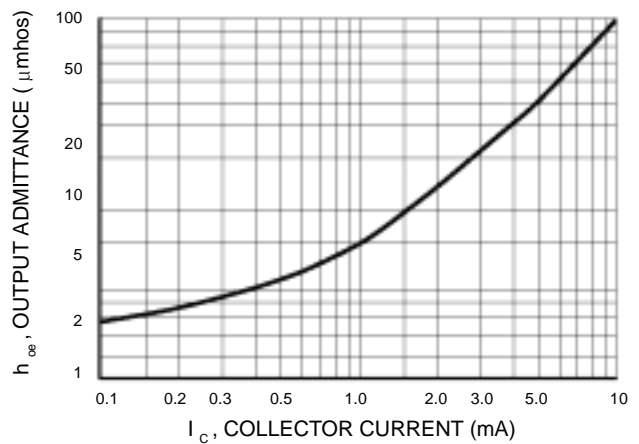


Figure 10. Output Admittance

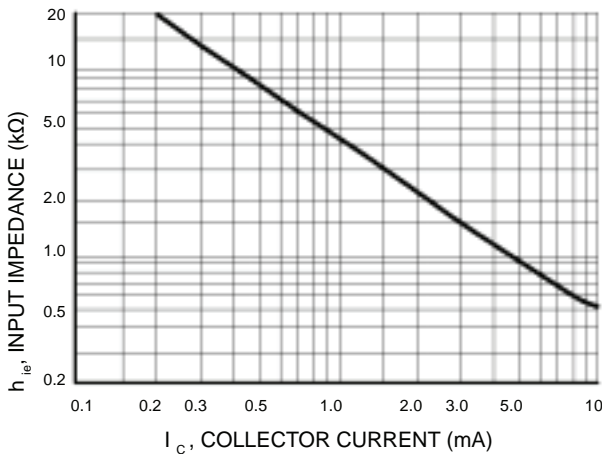


Figure 11. Input Impedance

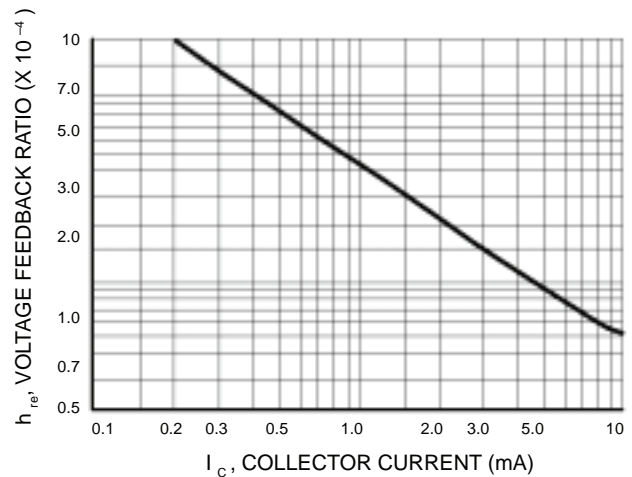


Figure 12. Voltage Feedback Ratio

## TYPICAL STATIC CHARACTERISTICS

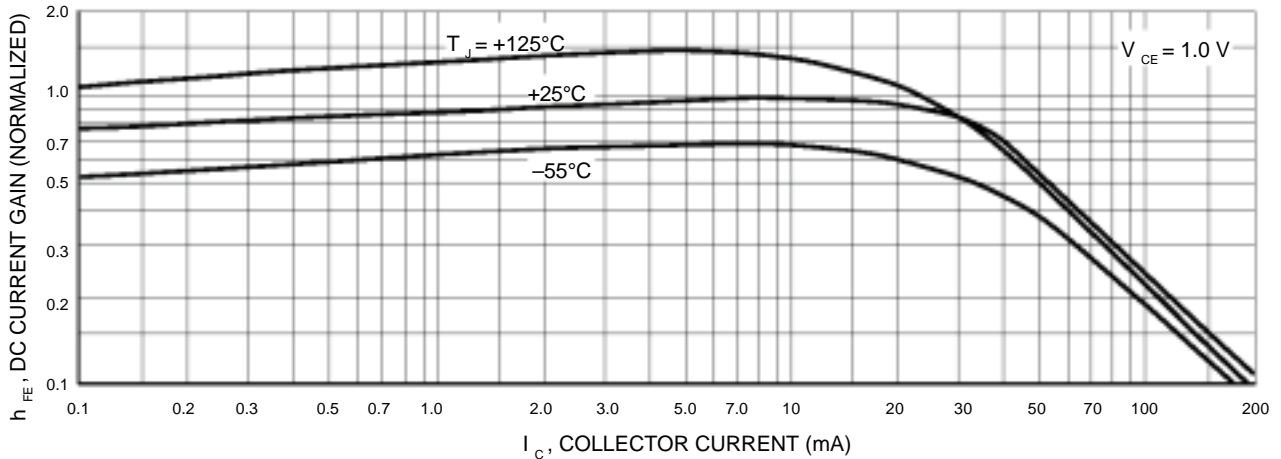


Figure 13. DC Current Gain

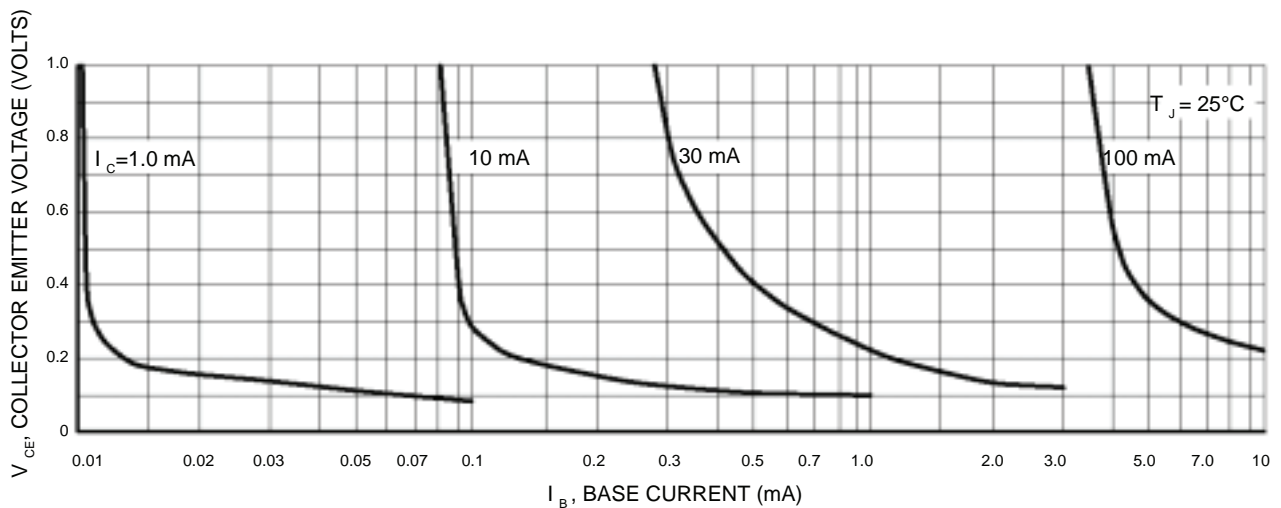


Figure 14. Collector Saturation Region

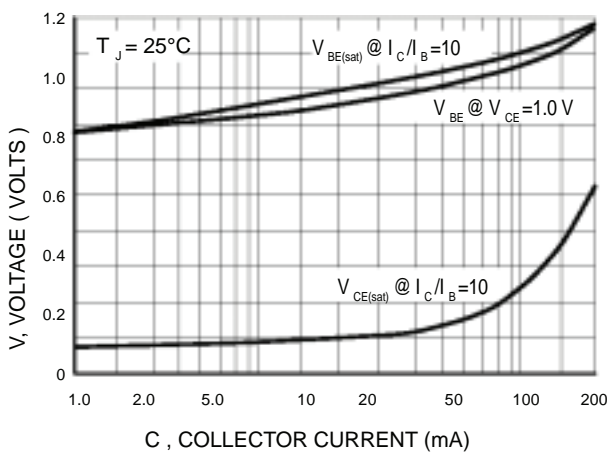


Figure 15. "ON" Voltages

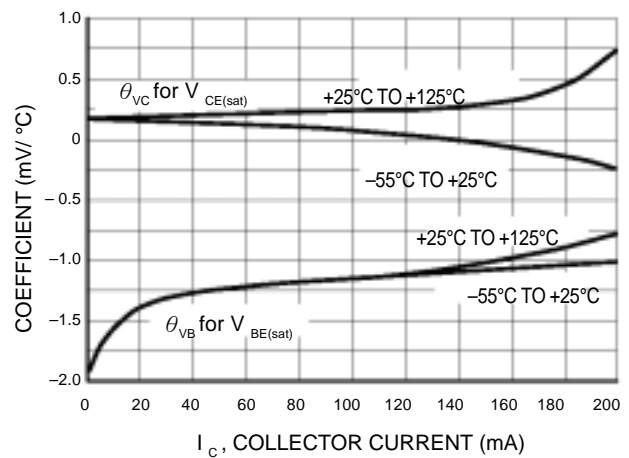


Figure 16. Temperature Coefficients

## SC-89 Package Outline Dimensions

Unit:mm

