

# General Purpose Transistors

## PNP Silicon

This transistor is designed for general purpose amplifier applications. It is housed in the SOT-416/SC-75 package which is designed for low power surface mount applications.

### Features

- Pb-Free Package is Available

### MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	-40	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	-40	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	-5.0	Vdc
Collector Current - Continuous	I <sub>C</sub>	-200	mAdc

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation, FR-4 Board (Note 1) @T <sub>A</sub> = 25°C Derated above 25°C	P <sub>D</sub>	200 1.6	mW mW/°C
Thermal Resistance, Junction-to-Ambient (Note 1)	R <sub>θJA</sub>	600	°C/W
Total Device Dissipation, FR-4 Board (Note 2) @T <sub>A</sub> = 25°C Derated above 25°C	P <sub>D</sub>	300 2.4	mW mW/°C
Thermal Resistance, Junction-to-Ambient (Note 2)	R <sub>θJA</sub>	400	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

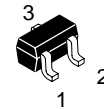
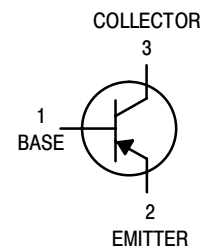
- FR-4 @ Minimum Pad
- FR-4 @ 1.0 × 1.0 Inch Pad



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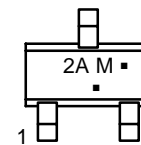
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## GENERAL PURPOSE AMPLIFIER TRANSISTORS SURFACE MOUNT



CASE 463  
SOT-416/SC-75  
STYLE 1

### MARKING DIAGRAM



2A = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)  
\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping†
MMBT3906TT1	SOT-416	3000 / Tape & Reel
MMBT3906TT1G	SOT-416 (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure. BRD8011/D.

# MMBT3906TT1

**ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = -1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	-40	-	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = -10 μA <sub>dc</sub> , I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	-40	-	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = -10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	-5.0	-	V <sub>dc</sub>
Base Cutoff Current (V <sub>CE</sub> = -30 V <sub>dc</sub> , V <sub>EB</sub> = -3.0 V <sub>dc</sub> )	I <sub>BL</sub>	-	-50	nA <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = -30 V <sub>dc</sub> , V <sub>EB</sub> = -3.0 V <sub>dc</sub> )	I <sub>CEX</sub>	-	-50	nA <sub>dc</sub>

<b>ON CHARACTERISTICS</b> (Note 3)				
DC Current Gain (I <sub>C</sub> = -0.1 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -1.0 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -10 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> ) (I <sub>C</sub> = -100 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> )	h <sub>FE</sub>	60 80 100 60 30	- - 300 - -	-
Collector–Emitter Saturation Voltage (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -5.0 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	- -	-0.25 -0.4	V <sub>dc</sub>
Base–Emitter Saturation Voltage (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -5.0 mA <sub>dc</sub> )	V <sub>BE(sat)</sub>	-0.65 -	-0.85 -0.95	V <sub>dc</sub>

<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Current–Gain–Bandwidth Product (I <sub>C</sub> = -10 mA <sub>dc</sub> , V <sub>CE</sub> = -20 V <sub>dc</sub> , f = 100 MHz)	f <sub>T</sub>	250	-	MHz
Output Capacitance (V <sub>CB</sub> = -5.0 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	-	4.5	pF
Input Capacitance <sup>1</sup> (V <sub>EB</sub> = -0.5 V <sub>dc</sub> , I <sub>C</sub> = 0, f = 1.0 MHz)	C <sub>ibo</sub>	-	10.0	pF
Input Impedance (V <sub>CE</sub> = -10 V <sub>dc</sub> , I <sub>C</sub> = -1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>ie</sub>	2.0	12	k Ω
Voltage Feedback Ratio (V <sub>CE</sub> = -10 V <sub>dc</sub> , I <sub>C</sub> = -1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>re</sub>	0.1	10	X 10 <sup>-4</sup>
Small–Signal Current Gain (V <sub>CE</sub> = -10 V <sub>dc</sub> , I <sub>C</sub> = -1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>fe</sub>	100	400	-
Output Admittance (V <sub>CE</sub> = -10 V <sub>dc</sub> , I <sub>C</sub> = -1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>oe</sub>	3.0	60	μmhos
Noise Figure (V <sub>CE</sub> = -5.0 V <sub>dc</sub> , I <sub>C</sub> = -100 μA <sub>dc</sub> , R <sub>S</sub> = 1.0 k Ω, f = 1.0 kHz)	NF	-	4.0	dB

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

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

# MMBT3906TT1

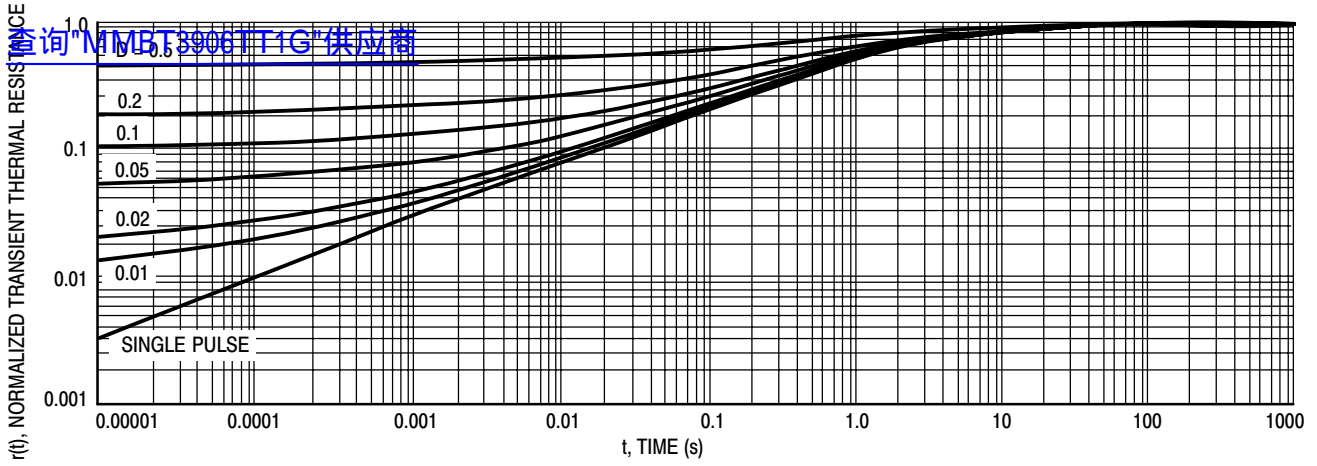


Figure 1. Normalized Thermal Response

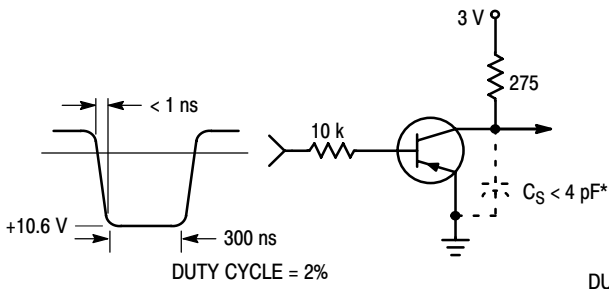


Figure 2. Delay and Rise Time Equivalent Test Circuit

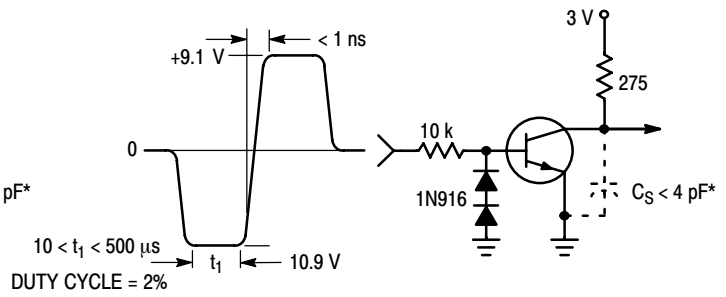


Figure 3. Storage and Fall Time Equivalent Test Circuit

\* Total shunt capacitance of test jig and connectors

## TYPICAL TRANSIENT CHARACTERISTICS

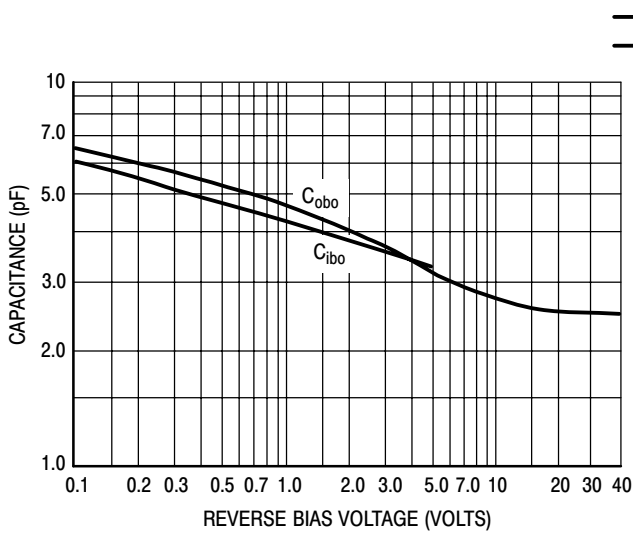


Figure 4. Capacitance

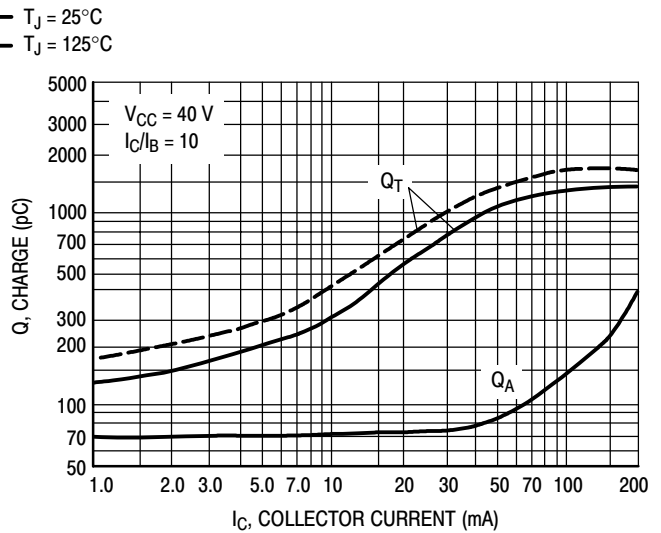
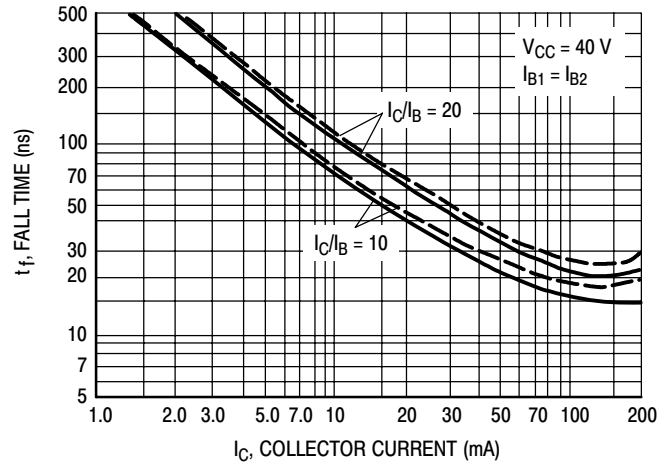
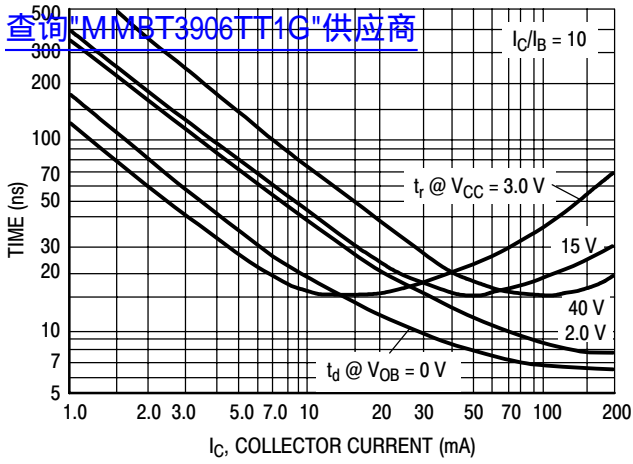


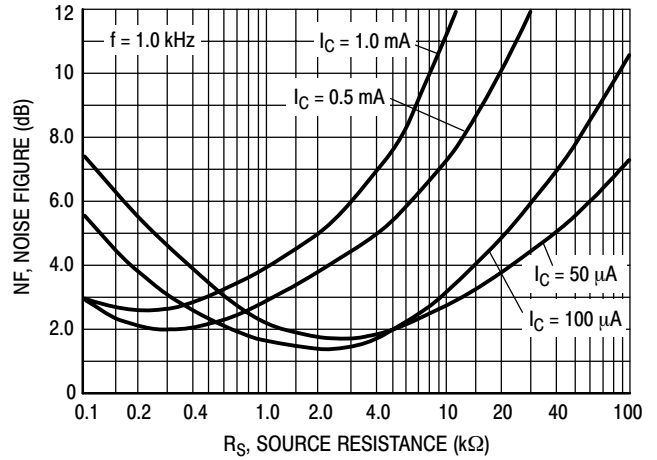
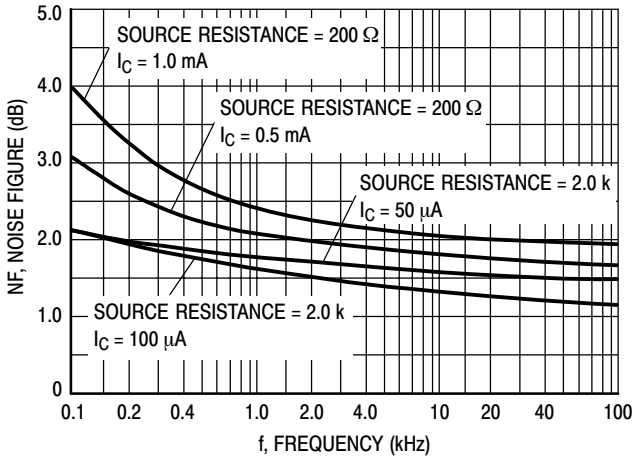
Figure 5. Charge Data

# MMBT3906TT1



## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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



# MMBT3906TT1

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## h PARAMETERS

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

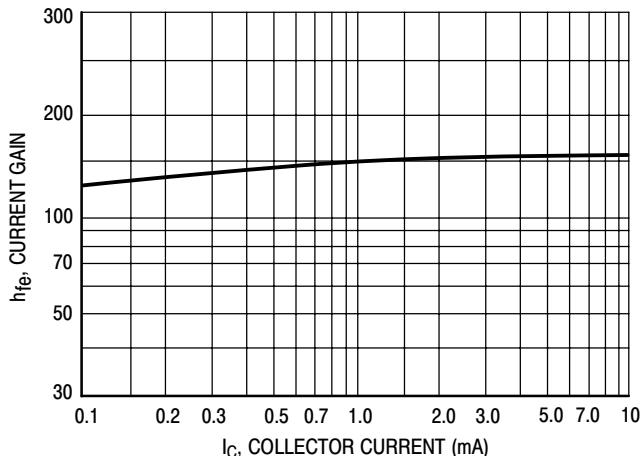


Figure 10. Current Gain

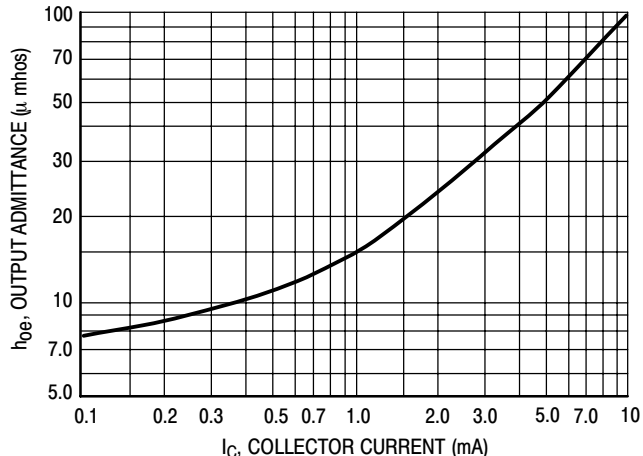


Figure 11. Output Admittance

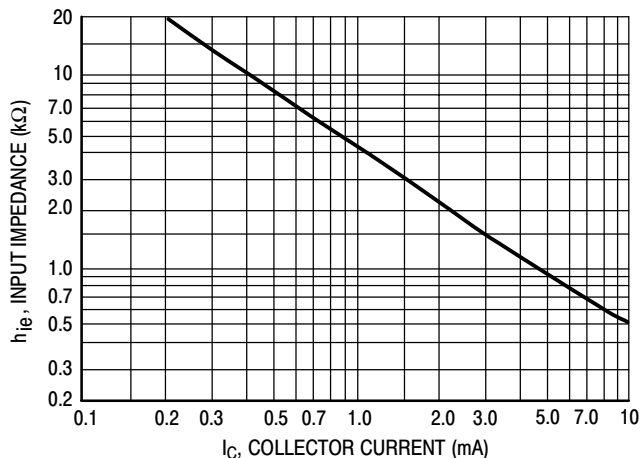


Figure 12. Input Impedance

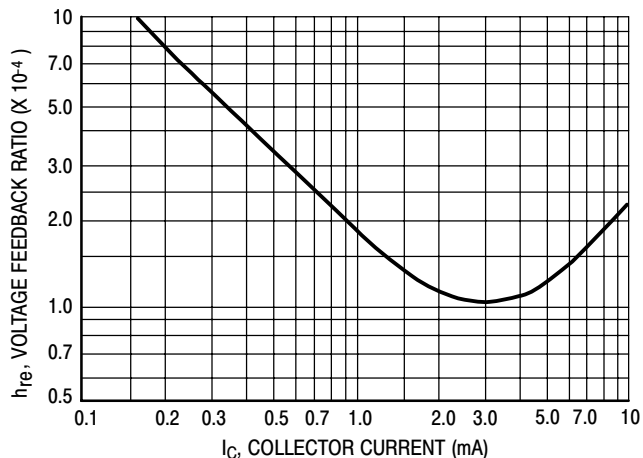


Figure 13. Voltage Feedback Ratio

## STATIC CHARACTERISTICS

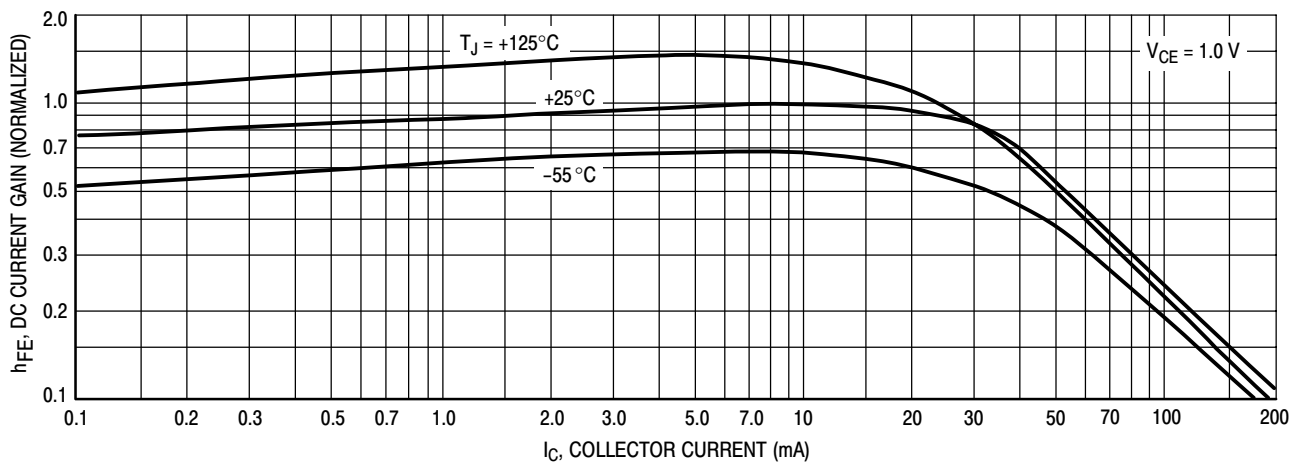


Figure 14. DC Current Gain

# MMBT3906TT1

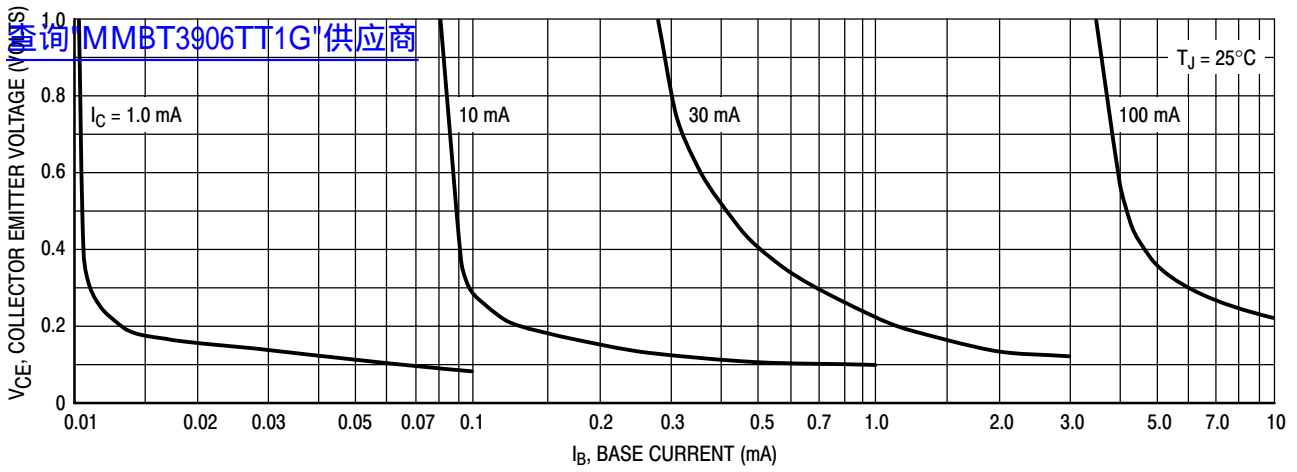


Figure 15. Collector Saturation Region

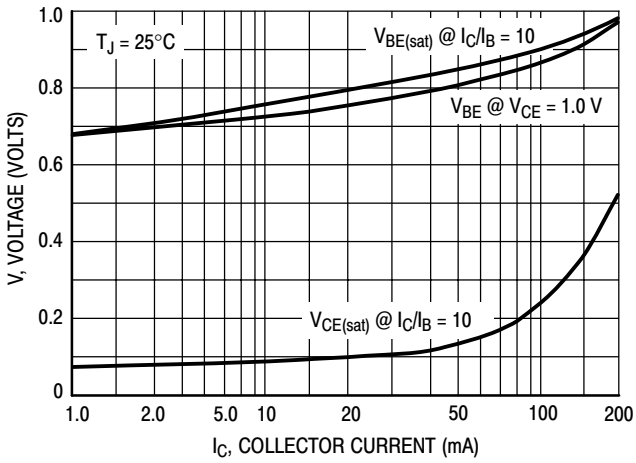


Figure 16. "ON" Voltages

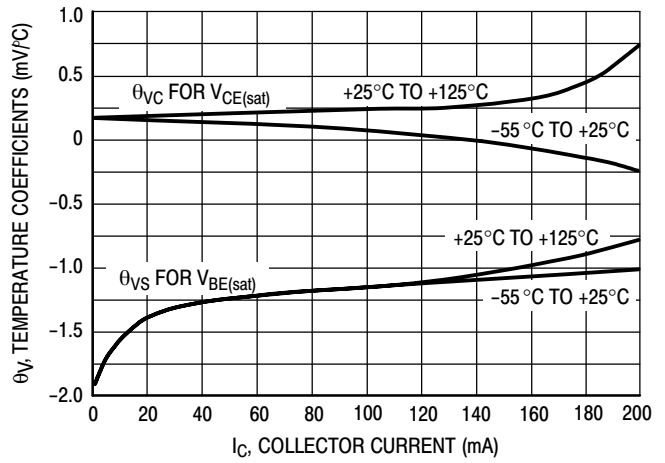


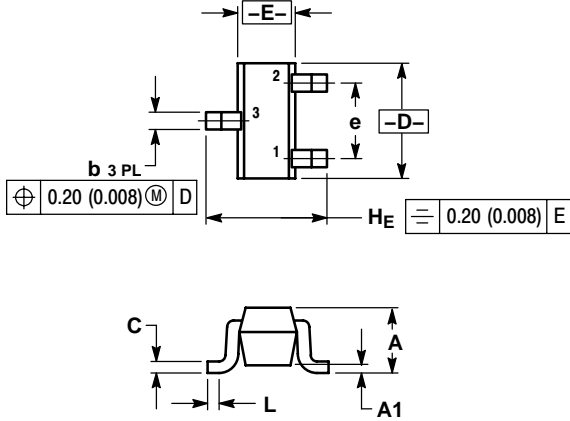
Figure 17. Temperature Coefficients

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## PACKAGE DIMENSIONS

SC-75/SOT-416  
CASE 463-01  
ISSUE F

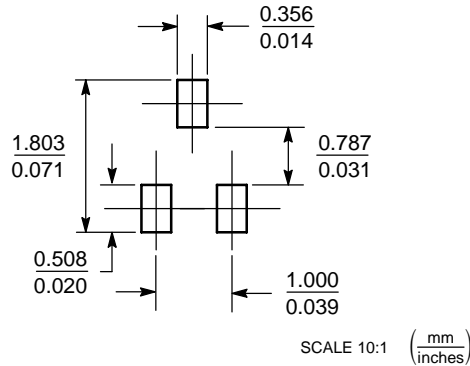


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.027	0.031	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
b	0.15	0.20	0.30	0.006	0.008	0.012
C	0.10	0.15	0.25	0.004	0.006	0.010
D	1.55	1.60	1.65	0.059	0.063	0.067
E	0.70	0.80	0.90	0.027	0.031	0.035
e	1.00 BSC			0.04 BSC		
L	0.10	0.15	0.20	0.004	0.006	0.008
H <sub>E</sub>	1.50	1.60	1.70	0.061	0.063	0.065

- STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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**MMBT3906TT1/D**