

# MMBT3906LT1

Preferred Device

## General Purpose Transistor

### PNP Silicon

#### Features

- Pb-Free Packages are Available

#### MAXIMUM RATINGS

Rating	Symbol	Value	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
Collector Current - Peak (Note 3)	$I_{CM}$	-800	mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

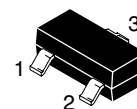
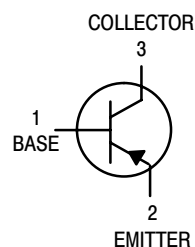
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

- FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
- Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.
- Reference SOA curve.



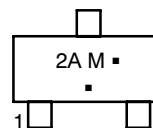
ON Semiconductor®

<http://onsemi.com>



SOT-23 (TO-236)  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



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

(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping†
MMBT3906LT1	SOT-23	3,000 / Tape & Reel
MMBT3906LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBT3906LT3	SOT-23	10,000 / Tape & Reel
MMBT3906LT3G	SOT-23 (Pb-Free)	10,000 / 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.

Preferred devices are recommended choices for future use and best overall value.

# MMBT3906LT1

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector - Emitter Breakdown Voltage (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>

## ON CHARACTERISTICS (Note 4)

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>

## SMALL-SIGNAL CHARACTERISTICS

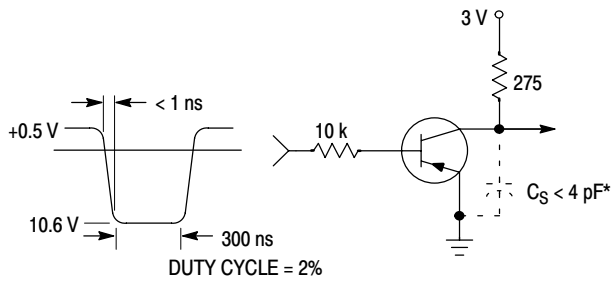
Current - Gain - Bandwidth Product (I <sub>C</sub> = -10 mA <sub>dc</sub> , V <sub>CE</sub> = -20 V <sub>dc</sub> , f = 100 MHz)	f <sub>T</sub>	250	-	MHz
Output Capacitance (V <sub>CB</sub> = -5.0 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	-	4.5	pF
Input Capacitance (V <sub>EB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

## SWITCHING CHARACTERISTICS

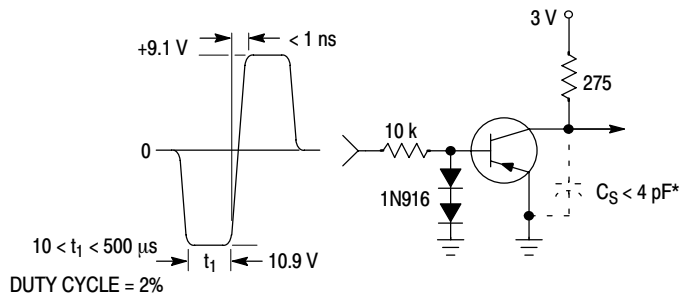
Delay Time	(V <sub>CC</sub> = -3.0 V <sub>dc</sub> , V <sub>BE</sub> = 0.5 V <sub>dc</sub> , I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B1</sub> = -1.0 mA <sub>dc</sub> )	t <sub>d</sub>	-	35	ns
Rise Time		t <sub>r</sub>	-	35	
Storage Time	(V <sub>CC</sub> = -3.0 V <sub>dc</sub> , I <sub>C</sub> =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

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

# MMBT3906LT1



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

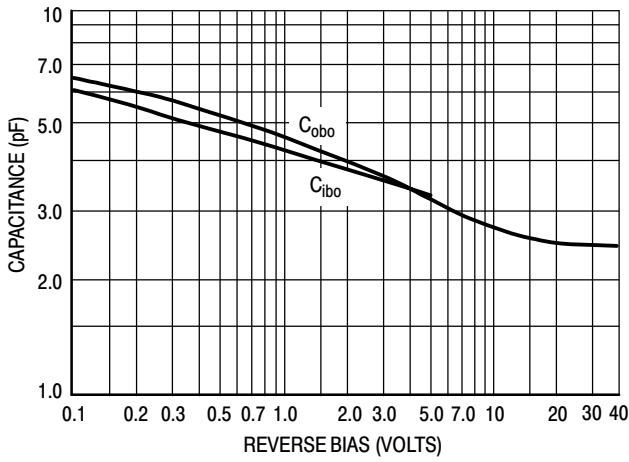


**Figure 2. Storage and Fall Time Equivalent Test Circuit**

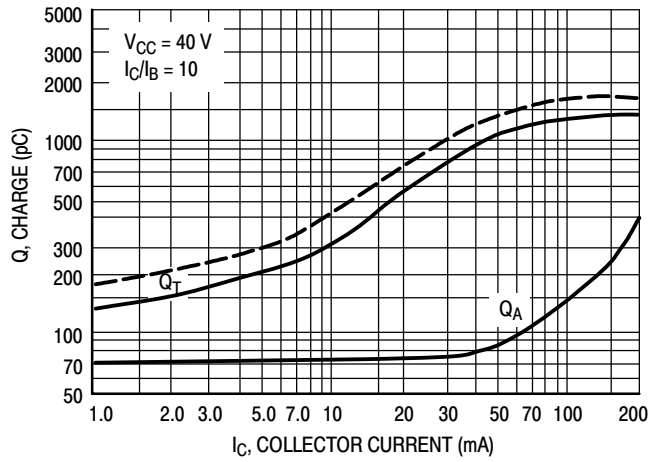
\* Total shunt capacitance of test jig and connectors

## TYPICAL TRANSIENT CHARACTERISTICS

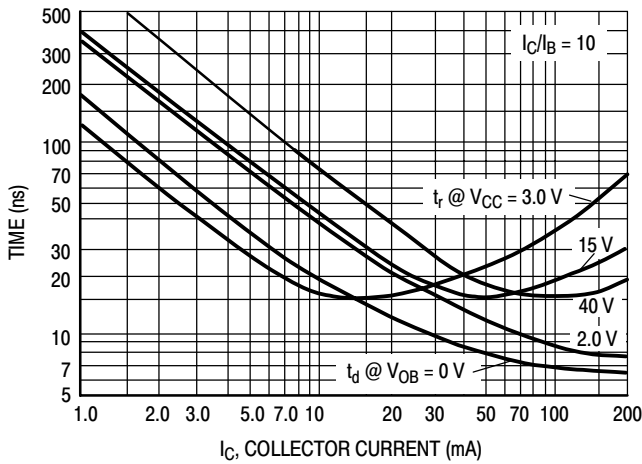
—  $T_J = 25^\circ\text{C}$   
 - - -  $T_J = 125^\circ\text{C}$



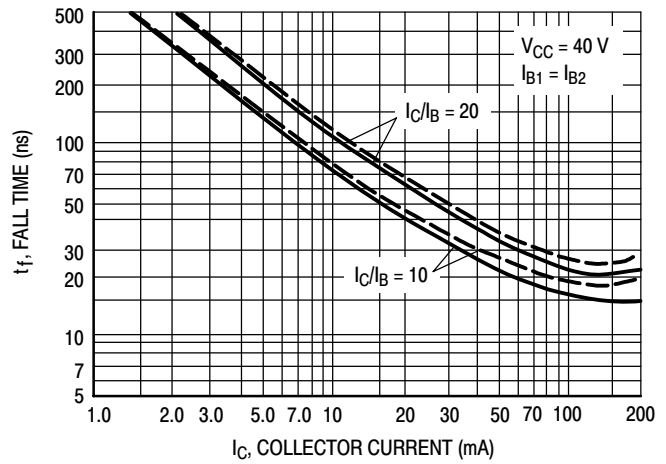
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. Fall Time**

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## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

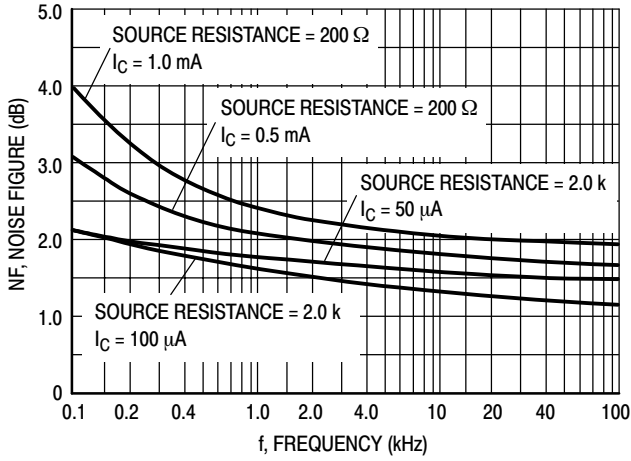


Figure 7.

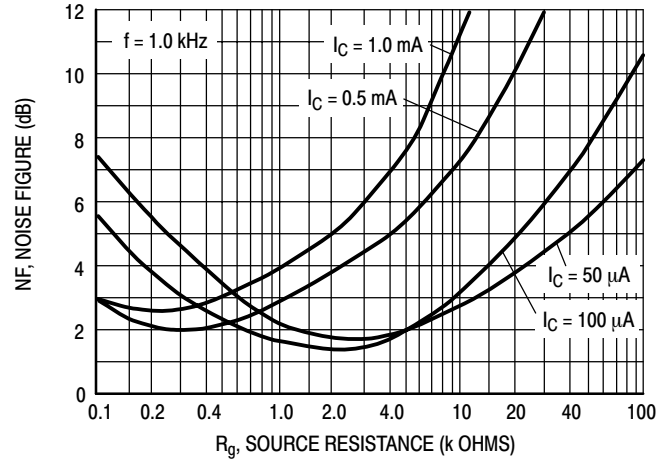


Figure 8.

## h PARAMETERS

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

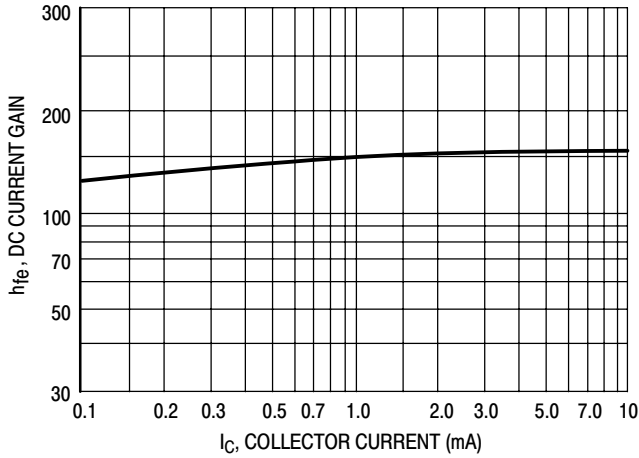


Figure 9. Current Gain

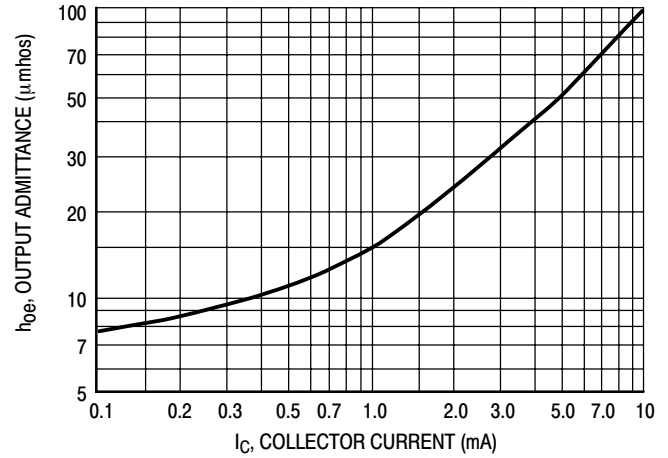


Figure 10. Output Admittance

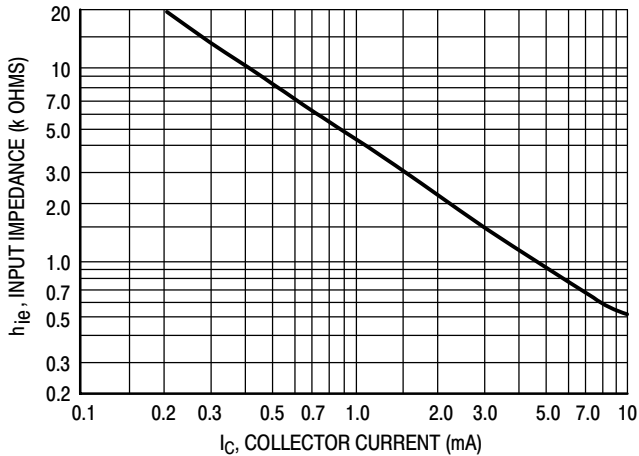


Figure 11. Input Impedance

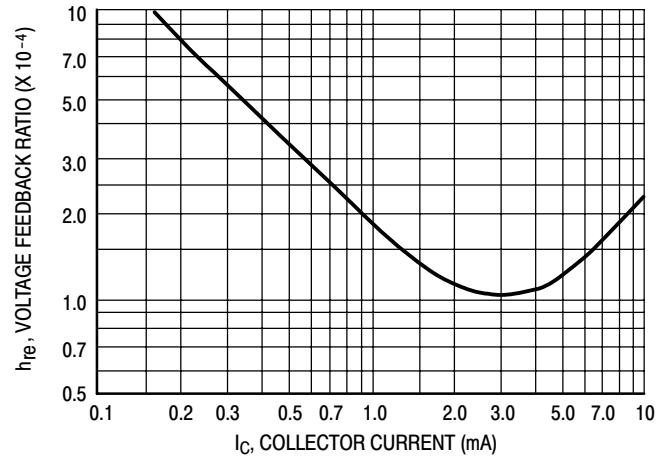


Figure 12. Voltage Feedback Ratio

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## TYPICAL STATIC CHARACTERISTICS

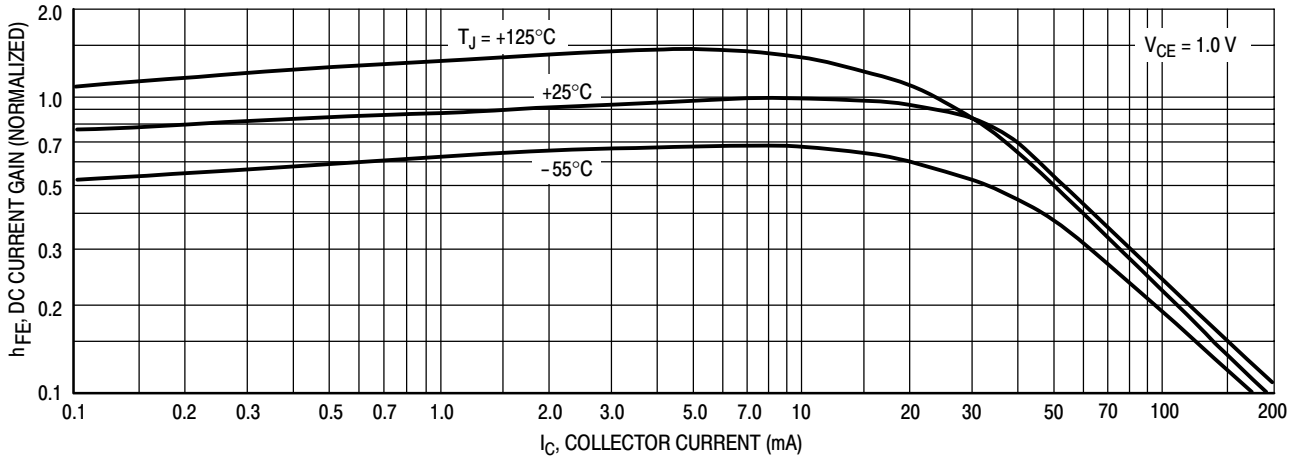


Figure 13. DC Current Gain

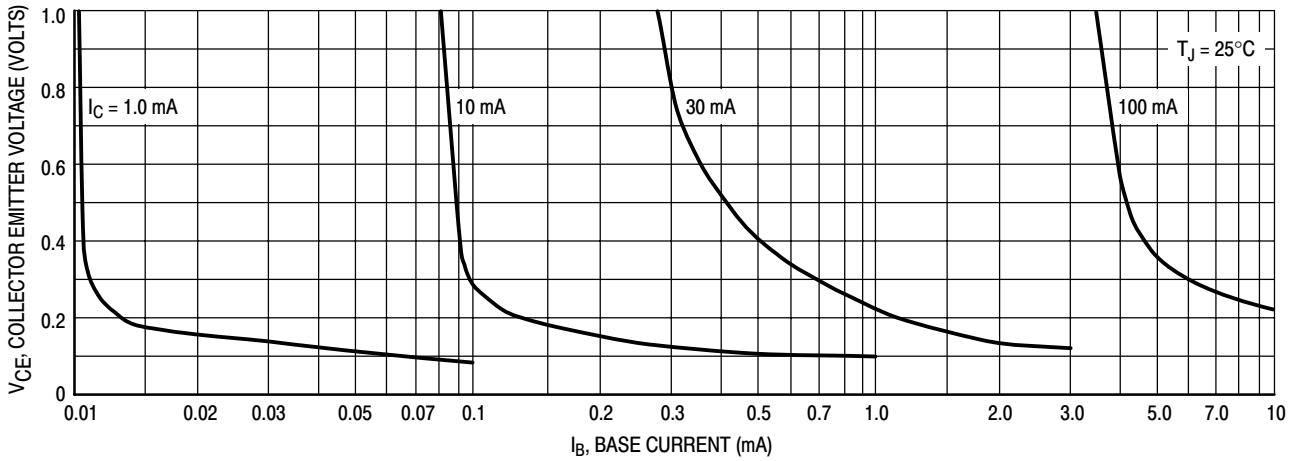


Figure 14. Collector Saturation Region

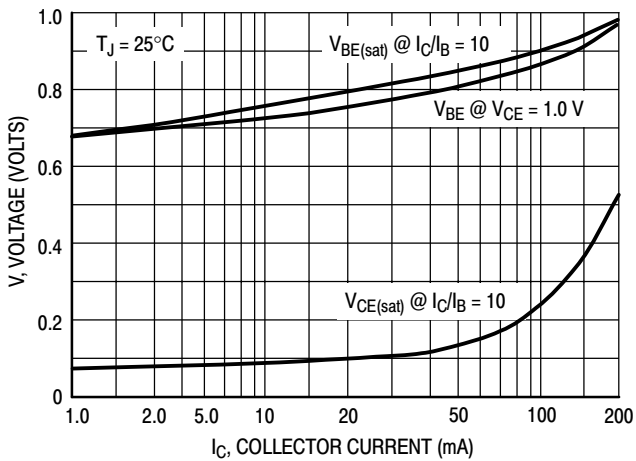


Figure 15. "ON" Voltages

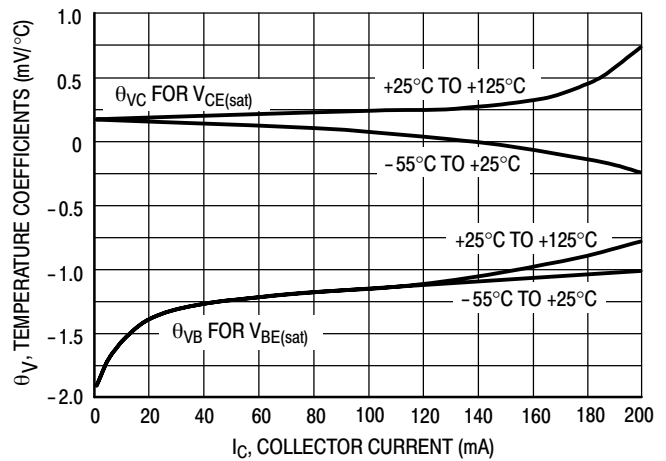


Figure 16. Temperature Coefficients

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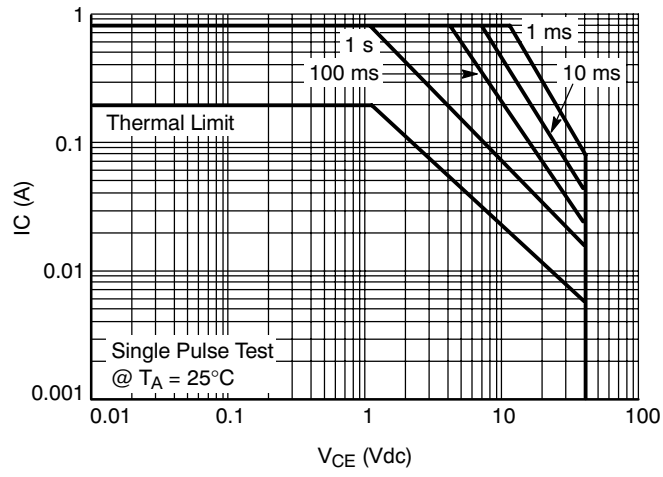
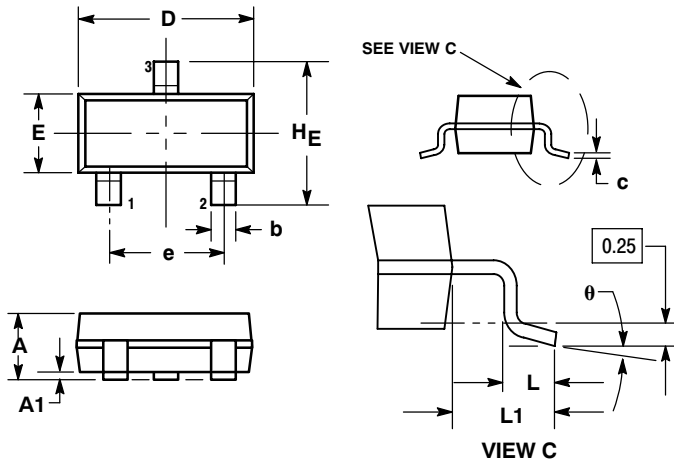


Figure 17. Safe Operating Area

# MMBT3906LT1

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AN



### NOTES:

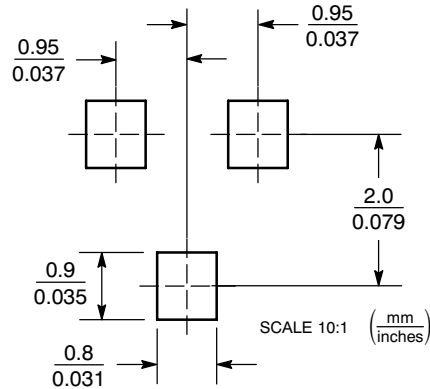
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104

### STYLE 6:

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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