

# MMBT3906L, SMMBT3906L

## General Purpose Transistor

### PNP Silicon

#### Features

- AEC-Q101 Qualified and PPAP Capable
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

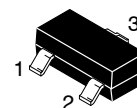
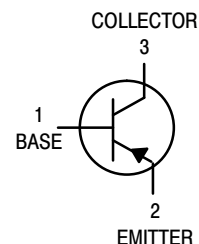
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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



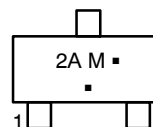
ON Semiconductor®

<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†            |
|---------------|---------------------|----------------------|
| MMBT3906LT1G  | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| MMBT3906LT3G  | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |
| SMMBT3906LT1G | SOT-23<br>(Pb-Free) | 3,000 / Tape & Reel  |
| SSMBT3906LT3G | SOT-23<br>(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.

# MMBT3906L, SMMBT3906L

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

| Characteristic                                                                         | Symbol        | Min  | Max | Unit |
|----------------------------------------------------------------------------------------|---------------|------|-----|------|
| <b>OFF CHARACTERISTICS</b>                                                             |               |      |     |      |
| Collector – Emitter Breakdown Voltage<br>( $I_C = -1.0\text{ mA}$ , $I_B = 0$ )        | $V_{(BR)CEO}$ | -40  | –   | Vdc  |
| Collector – Base Breakdown Voltage<br>( $I_C = -10\text{ }\mu\text{A}$ , $I_E = 0$ )   | $V_{(BR)CBO}$ | -40  | –   | Vdc  |
| Emitter – Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{A}$ , $I_C = 0$ )     | $V_{(BR)EBO}$ | -5.0 | –   | Vdc  |
| Base Cutoff Current<br>( $V_{CE} = -30\text{ Vdc}$ , $V_{EB} = -3.0\text{ Vdc}$ )      | $I_{BL}$      | –    | -50 | nAdc |
| Collector Cutoff Current<br>( $V_{CE} = -30\text{ Vdc}$ , $V_{EB} = -3.0\text{ Vdc}$ ) | $I_{CEX}$     | –    | -50 | nAdc |

## ON CHARACTERISTICS (Note 4)

|                                                                                                                                                                                                                                                                                                                      |               |                             |                         |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------|-------------------------|-----|
| DC Current Gain<br>( $I_C = -0.1\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -50\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ )<br>( $I_C = -100\text{ mA}$ , $V_{CE} = -1.0\text{ Vdc}$ ) | $H_{FE}$      | 60<br>80<br>100<br>60<br>30 | –<br>–<br>300<br>–<br>– | –   |
| Collector – Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -50\text{ mA}$ , $I_B = -5.0\text{ mA}$ )                                                                                                                                                                   | $V_{CE(sat)}$ | –<br>–                      | -0.25<br>-0.4           | Vdc |
| Base – Emitter Saturation Voltage<br>( $I_C = -10\text{ mA}$ , $I_B = -1.0\text{ mA}$ )<br>( $I_C = -50\text{ mA}$ , $I_B = -5.0\text{ mA}$ )                                                                                                                                                                        | $V_{BE(sat)}$ | -0.65<br>–                  | -0.85<br>-0.95          | Vdc |

## SMALL-SIGNAL CHARACTERISTICS

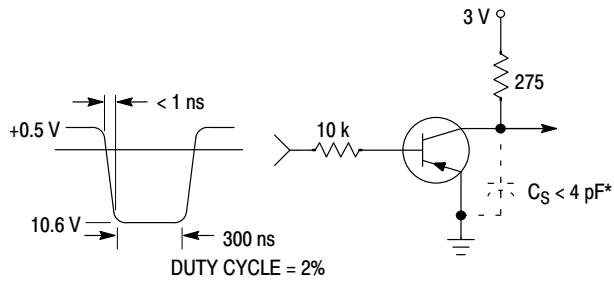
|                                                                                                                                      |           |     |     |                  |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|------------------|
| Current – Gain – Bandwidth Product<br>( $I_C = -10\text{ mA}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                   | $f_T$     | 250 | –   | MHz              |
| Output Capacitance<br>( $V_{CB} = -5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                              | $C_{obo}$ | –   | 4.5 | pF               |
| Input Capacitance<br>( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )                                               | $C_{ibo}$ | –   | 10  | pF               |
| Input Impedance<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                     | $h_{ie}$  | 2.0 | 12  | k $\Omega$       |
| Voltage Feedback Ratio<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                              | $h_{re}$  | 0.1 | 10  | $\times 10^{-4}$ |
| Small – Signal Current Gain<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                         | $h_{fe}$  | 100 | 400 | –                |
| Output Admittance<br>( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                   | $h_{oe}$  | 3.0 | 60  | $\mu\text{mhos}$ |
| Noise Figure<br>( $I_C = -100\text{ }\mu\text{A}$ , $V_{CE} = -5.0\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ ) | NF        | –   | 4.0 | dB               |

## SWITCHING CHARACTERISTICS

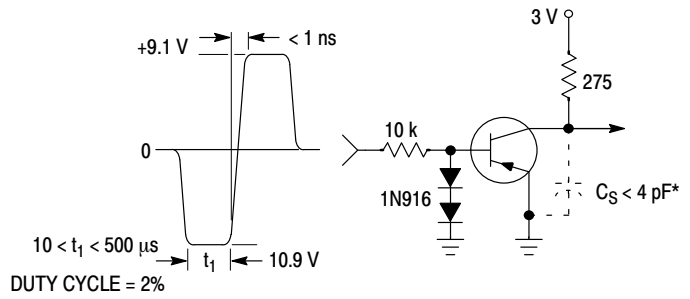
|              |                                                                                                                  |       |   |     |    |
|--------------|------------------------------------------------------------------------------------------------------------------|-------|---|-----|----|
| Delay Time   | $(V_{CC} = -3.0\text{ Vdc}$ , $V_{BE} = 0.5\text{ Vdc}$ ,<br>$I_C = -10\text{ mA}$ , $I_{B1} = -1.0\text{ mA}$ ) | $t_d$ | – | 35  | ns |
| Rise Time    |                                                                                                                  | $t_r$ | – | 35  |    |
| Storage Time | $(V_{CC} = -3.0\text{ Vdc}$ , $I_C = -10\text{ mA}$ ,<br>$I_{B1} = I_{B2} = -1.0\text{ mA}$ )                    | $t_s$ | – | 225 | ns |
| Fall Time    |                                                                                                                  | $t_f$ | – | 75  |    |

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

# MMBT3906L, SMMBT3906L



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

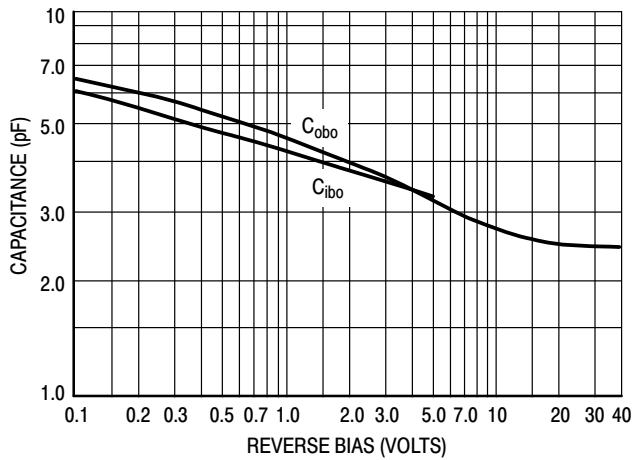


**Figure 2. Storage and Fall Time  
Equivalent Test Circuit**

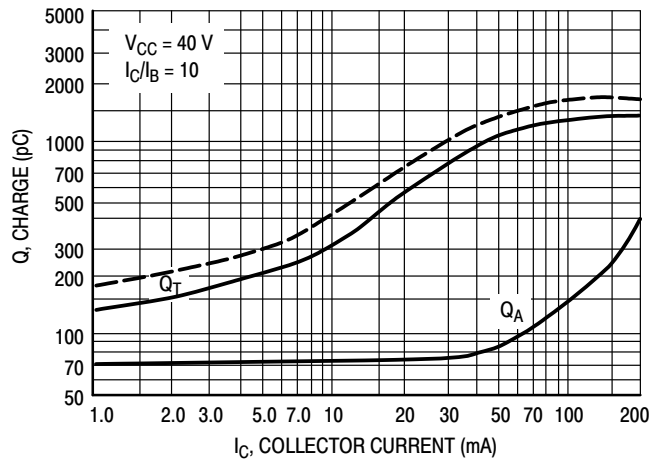
\* Total shunt capacitance of test jig and connectors

## TYPICAL TRANSIENT CHARACTERISTICS

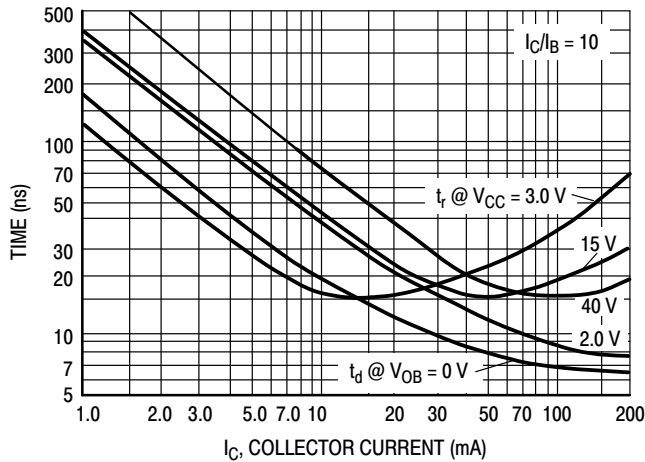
—  $T_J = 25^\circ\text{C}$   
- -  $T_J = 125^\circ\text{C}$



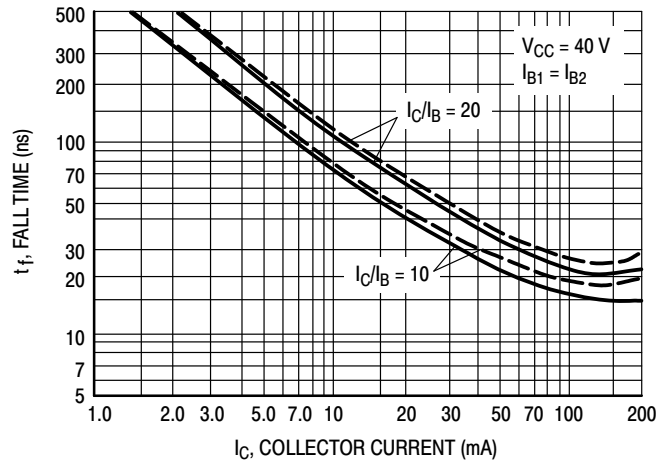
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. Fall Time**

# MMBT3906L, SMMBT3906L

## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

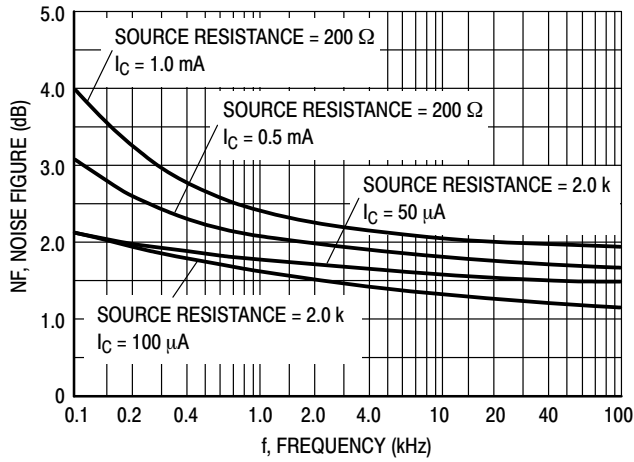


Figure 7.

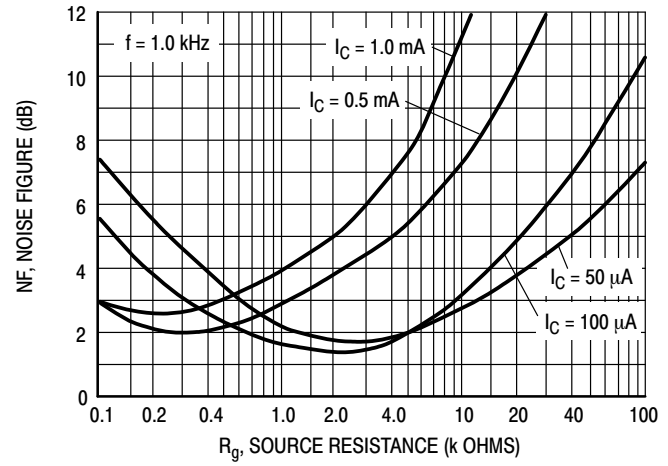


Figure 8.

## h PARAMETERS

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

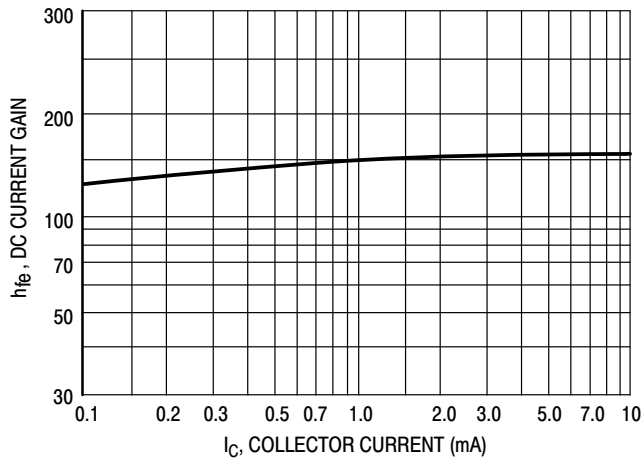


Figure 9. Current Gain

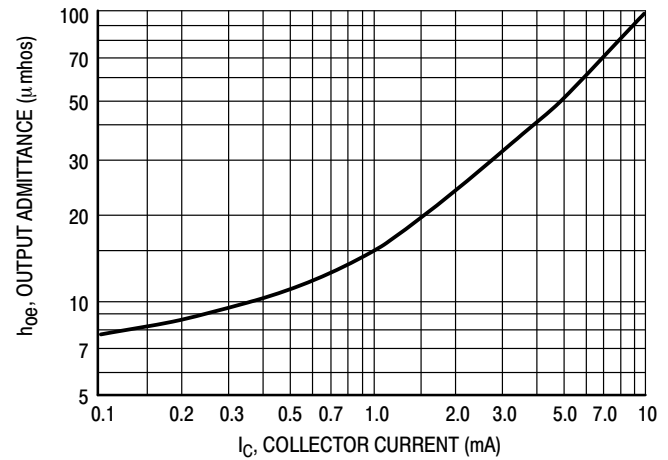


Figure 10. Output Admittance

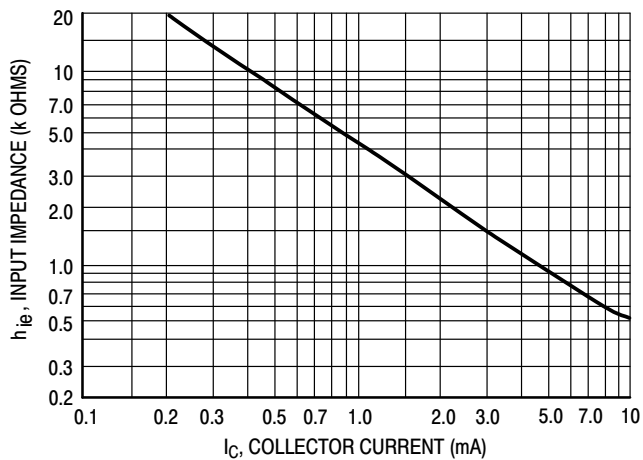


Figure 11. Input Impedance

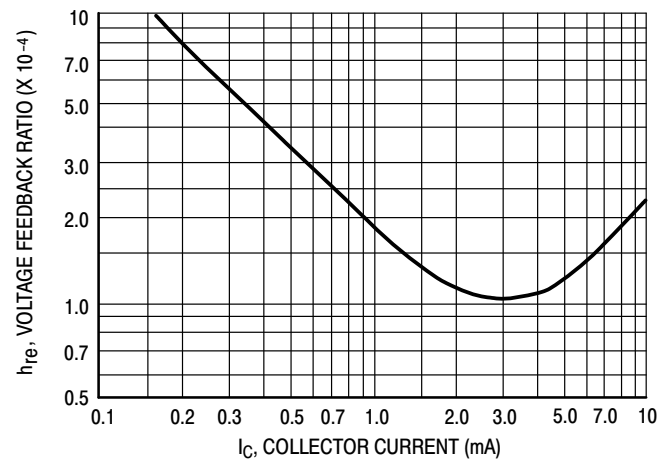


Figure 12. Voltage Feedback Ratio

# MMBT3906L, SMMBT3906L

## TYPICAL STATIC CHARACTERISTICS

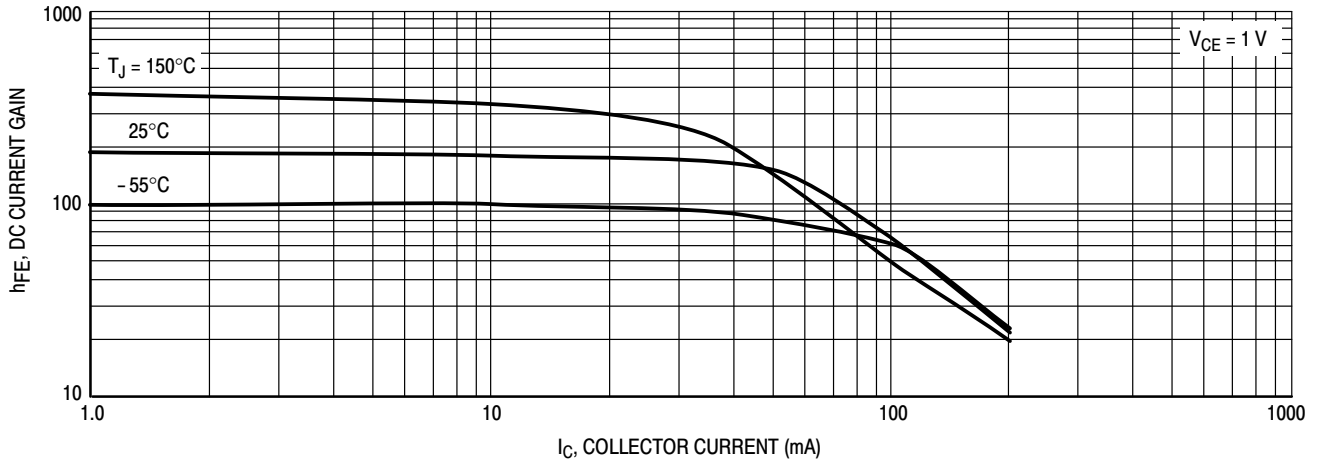


Figure 13. DC Current Gain

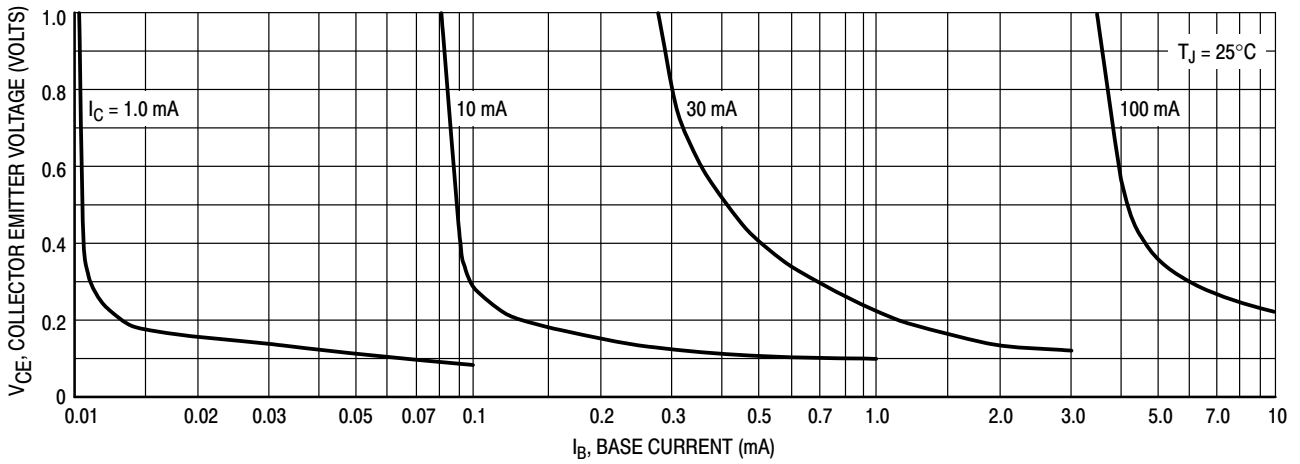
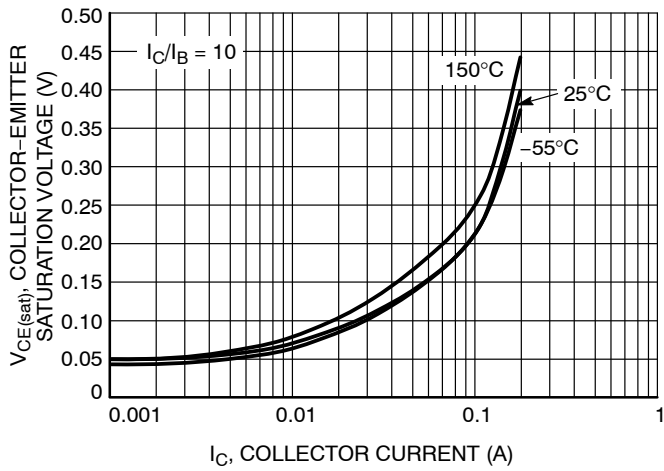
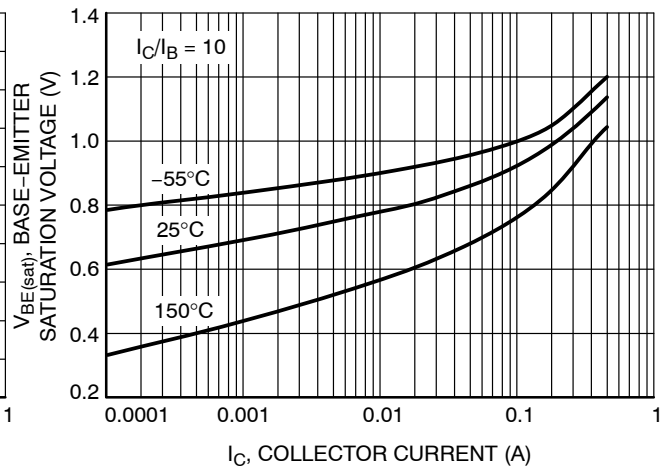


Figure 14. Collector Saturation Region

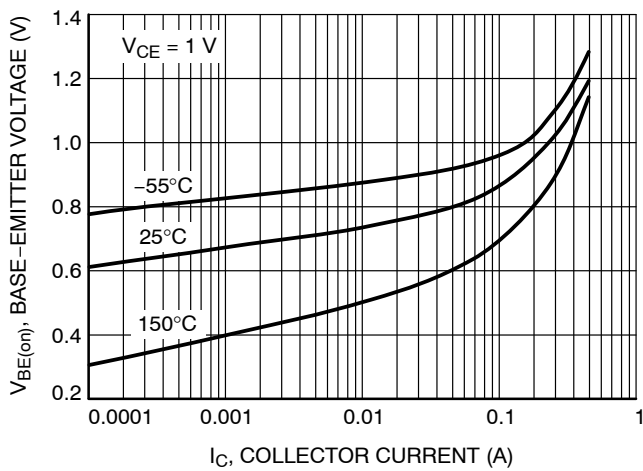
# MMBT3906L, SMMBT3906L



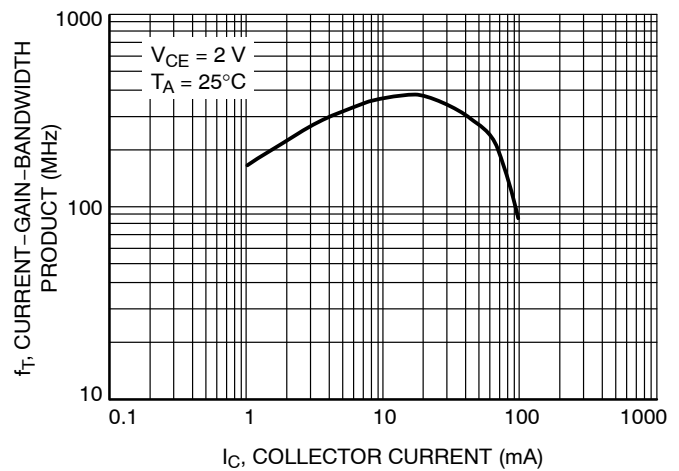
**Figure 15. Collector Emitter Saturation Voltage vs. Collector Current**



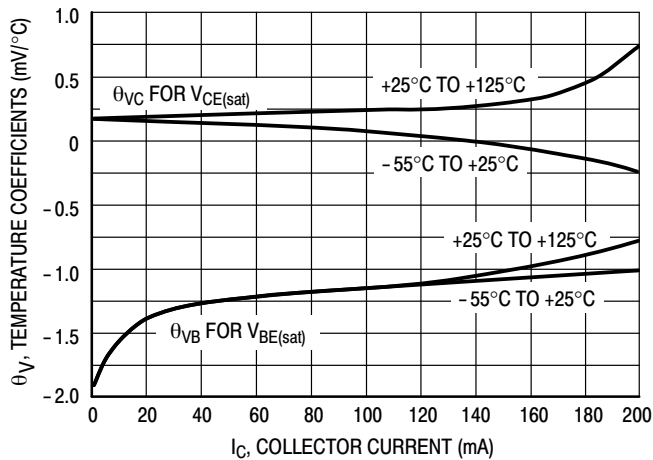
**Figure 16. Base Emitter Saturation Voltage vs. Collector Current**



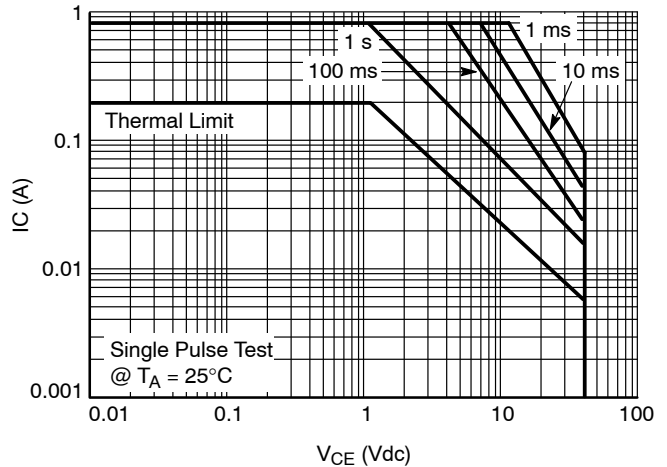
**Figure 17. Base Emitter Voltage vs. Collector Current**



**Figure 18. Current Gain Bandwidth vs. Collector Current**



**Figure 19. Temperature Coefficients**

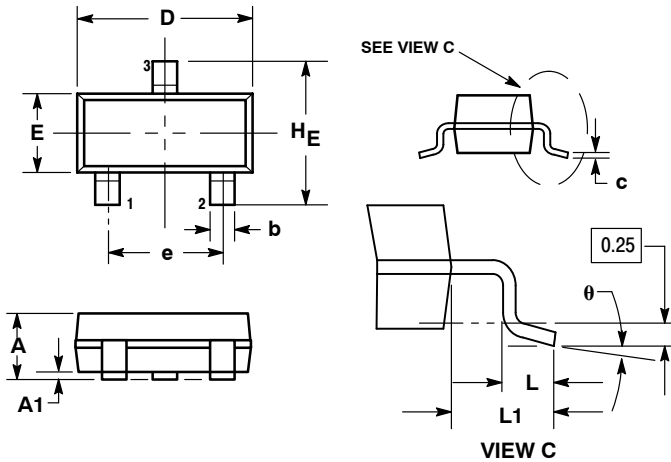


**Figure 20. Safe Operating Area**

# MMBT3906L, SMMBT3906L

## PACKAGE DIMENSIONS

### SOT-23 (TO-236) CASE 318-08 ISSUE AP

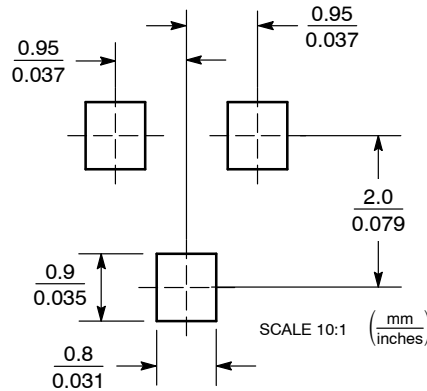


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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 |
| θ   | 0°          | —    | 10°  | 0°     | —     | 10°   |

STYLE 6:  
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.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9