



# THE DATASHEET OF MMBTH10LT1G



# MMBTH10L, MMBTH10-4L, SMMBTH10-4L, NSVMMBTH10L



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## VHF/UHF Transistor

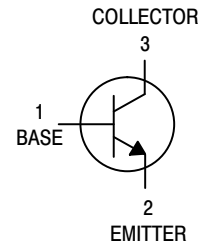
### NPN Silicon

#### Features

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



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



#### MAXIMUM RATINGS

| Rating                    | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Emitter Voltage | $V_{CEO}$ | 25    | Vdc  |
| Collector-Base Voltage    | $V_{CBO}$ | 30    | Vdc  |
| Emitter-Base Voltage      | $V_{EBO}$ | 3.0   | Vdc  |

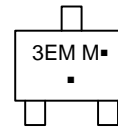
#### THERMAL CHARACTERISTICS

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

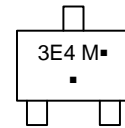
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina

#### MARKING DIAGRAMS



MMBTH10LT1G,  
NSVMMBTH10LT1G



MMBTH10-04LT1G

3EM, 3E4 = 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†               |
|--------------------------------|---------------------|-------------------------|
| MMBTH10LT1G                    | SOT-23<br>(Pb-Free) | 3,000 /<br>Tape & Reel  |
| NSVMMBTH10LT1G                 | SOT-23<br>(Pb-Free) | 3,000 /<br>Tape & Reel  |
| MMBTH10-4LT1G                  | SOT-23<br>(Pb-Free) | 3,000 /<br>Tape & Reel  |
| MMBTH10LT3G,<br>SMMBTH10-4LT3G | SOT-23<br>(Pb-Free) | 10,000 /<br>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.

# MMBTH10L, MMBTH10-4L, SMMBTH10-4L, NSVMMBTH10L

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|  |               |     |   |     |      |
|--|---------------|-----|---|-----|------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = 1.0\text{ mA}$ , $I_E = 0$ ) | $V_{(BR)CEO}$ | 25  | - | -   | Vdc  |
| Collector-Base Breakdown Voltage<br>( $I_C = 100\ \mu\text{A}$ , $I_E = 0$ ) | $V_{(BR)CBO}$ | 30  | - | -   | Vdc  |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10\ \mu\text{A}$ , $I_C = 0$ )    | $V_{(BR)EBO}$ | 3.0 | - | -   | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 25\text{ Vdc}$ , $I_E = 0$ )         | $I_{CBO}$     | -   | - | 100 | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 2.0\text{ Vdc}$ , $I_C = 0$ )          | $I_{EBO}$     | -   | - | 100 | nAdc |

### ON CHARACTERISTICS

|   |               |           |        |          |     |
|---|---------------|-----------|--------|----------|-----|
| DC Current Gain<br>( $I_C = 4.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )<br>MMBTH10LT1G, NSVMMBTH10LT1G<br>MMBTH10-4LT1G, SMMBTH10-4LT3G | $h_{FE}$      | 60<br>120 | -<br>- | -<br>240 | -   |
| Collector-Emitter Saturation Voltage<br>( $I_C = 4.0\text{ mA}$ , $I_E = 0.4\text{ mA}$ )   | $V_{CE(sat)}$ | -         | -      | 0.5      | Vdc |
| Base-Emitter On Voltage<br>( $I_C = 4.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )   | $V_{BE}$      | -         | -      | 0.95     | Vdc |

### SMALL-SIGNAL CHARACTERISTICS

|   |           |            |        |        |     |
|---|-----------|------------|--------|--------|-----|
| Current-Gain – Bandwidth Product<br>( $I_C = 4.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 100\text{ MHz}$ )<br>MMBTH10LT1G, NSVMMBTH10LT1G<br>MMBTH10-4LT1G, SMMBTH10-4LT3G | $f_T$     | 650<br>800 | -<br>- | -<br>- | MHz |
| Collector-Base Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )   | $C_{cb}$  | -          | -      | 0.7    | pF  |
| Common-Base Feedback Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )   | $C_{rb}$  | -          | -      | 0.65   | pF  |
| Collector Base Time Constant<br>( $I_C = 4.0\text{ mA}$ , $V_{CB} = 10\text{ Vdc}$ , $f = 31.8\text{ MHz}$ )  | $r_b'C_c$ | -          | -      | 9.0    | ps  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

COMMON-BASE y PARAMETERS versus FREQUENCY

( $V_{CB} = 10 \text{ Vdc}$ ,  $I_C = 4.0 \text{ mA dc}$ ,  $T_A = 25^\circ\text{C}$ )

$y_{ib}$ , INPUT ADMITTANCE

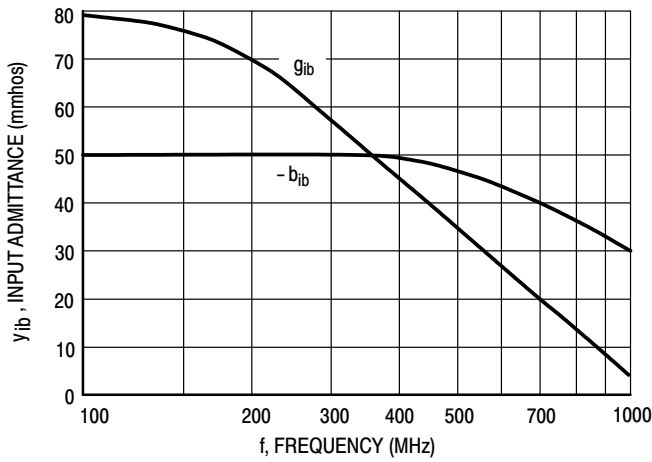


Figure 1. Rectangular Form

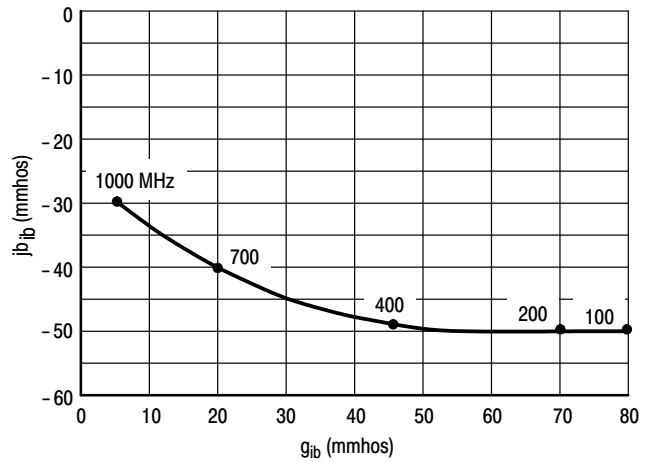


Figure 2. Polar Form

$y_{fb}$ , FORWARD TRANSFER ADMITTANCE

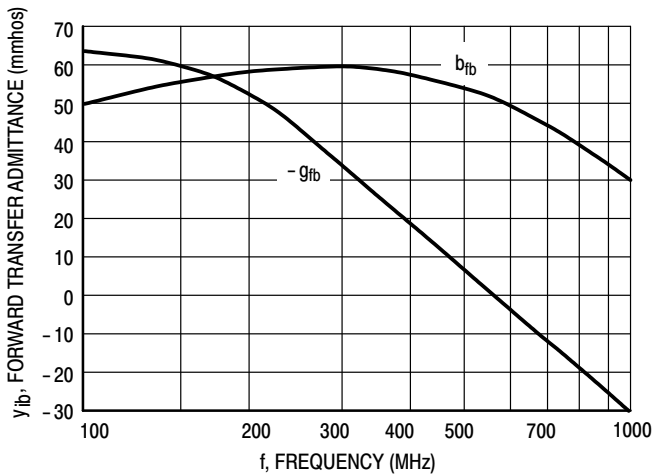


Figure 3. Rectangular Form

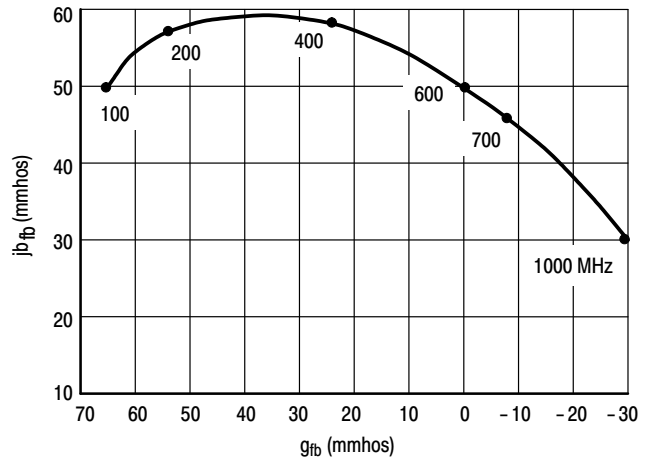


Figure 4. Polar Form

TYPICAL CHARACTERISTICS

COMMON-BASE  $y$  PARAMETERS versus FREQUENCY

( $V_{CB} = 10$  Vdc,  $I_C = 4.0$  mAdc,  $T_A = 25^\circ\text{C}$ )

$y_{rb}$ , REVERSE TRANSFER ADMITTANCE

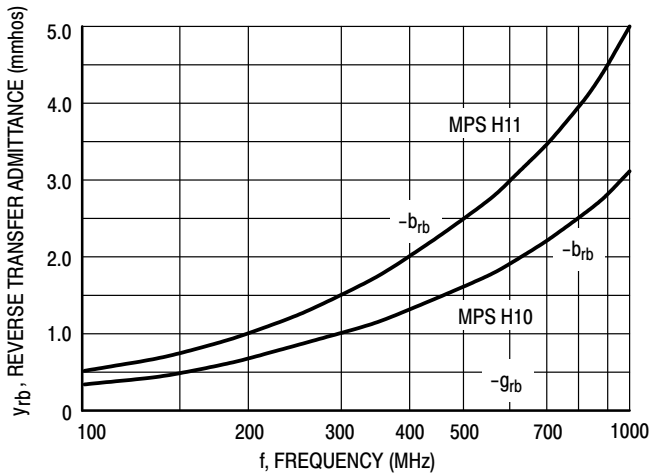


Figure 5. Rectangular Form

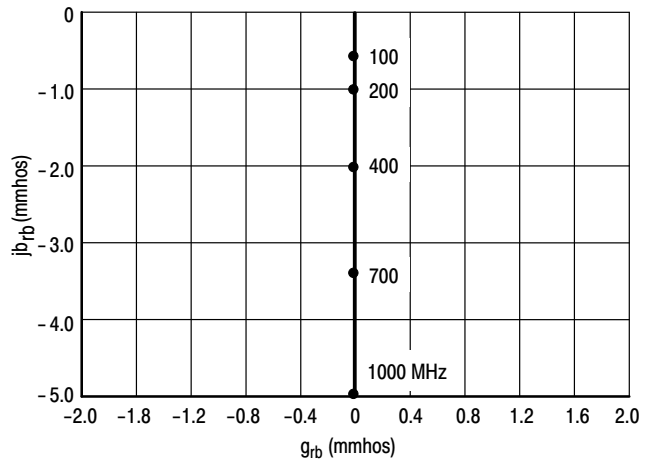


Figure 6. Polar Form

$y_{ob}$ , OUTPUT ADMITTANCE

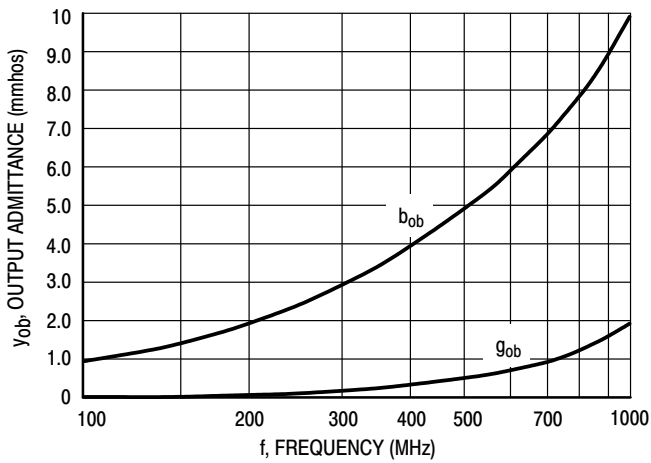


Figure 7. Rectangular Form

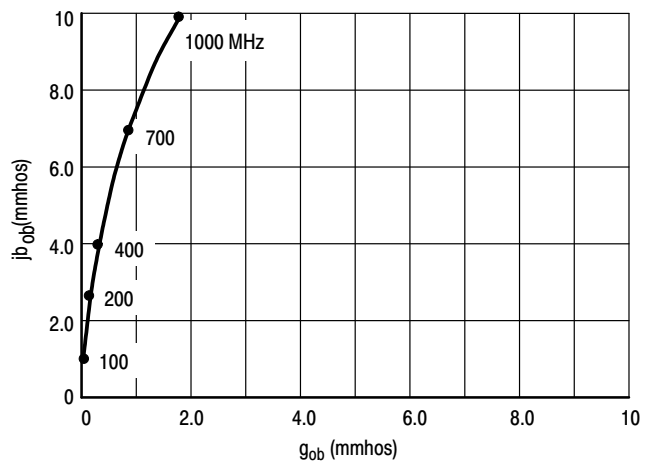


Figure 8. Polar Form

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**SOT-23 (TO-236)**  
CASE 318  
ISSUE AT

DATE 01 MAR 2023

SCALE 4:1



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE 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  | 0.039 | 0.044 |
| A1             | 0.01        | 0.06 | 0.10 | 0.000  | 0.002 | 0.004 |
| b              | 0.37        | 0.44 | 0.50 | 0.015  | 0.017 | 0.020 |
| c              | 0.08        | 0.14 | 0.20 | 0.003  | 0.006 | 0.008 |
| 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 | 0.080 |
| L              | 0.30        | 0.43 | 0.55 | 0.012  | 0.017 | 0.022 |
| L1             | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.027 |
| H <sub>E</sub> | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| T              | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

**GENERIC MARKING DIAGRAM\***



- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



**RECOMMENDED MOUNTING 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.

**STYLES ON PAGE 2**

|                         |                        |  |
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**MECHANICAL CASE OUTLINE  
PACKAGE DIMENSIONS**



**SOT-23 (TO-236)  
CASE 318  
ISSUE AT**

DATE 01 MAR 2023

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| STYLE 1 THRU 5:<br>CANCELLED                            | STYLE 6:<br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR | STYLE 7:<br>PIN 1. EMITTER<br>2. BASE<br>3. COLLECTOR       | STYLE 8:<br>PIN 1. ANODE<br>2. NO CONNECTION<br>3. CATHODE  |   |   |
| STYLE 9:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE      | STYLE 10:<br>PIN 1. DRAIN<br>2. SOURCE<br>3. GATE     | STYLE 11:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE-ANODE | STYLE 12:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. ANODE       | STYLE 13:<br>PIN 1. SOURCE<br>2. DRAIN<br>3. GATE           | STYLE 14:<br>PIN 1. CATHODE<br>2. GATE<br>3. ANODE          |
| STYLE 15:<br>PIN 1. GATE<br>2. CATHODE<br>3. ANODE      | STYLE 16:<br>PIN 1. ANODE<br>2. CATHODE<br>3. CATHODE | STYLE 17:<br>PIN 1. NO CONNECTION<br>2. ANODE<br>3. CATHODE | STYLE 18:<br>PIN 1. NO CONNECTION<br>2. CATHODE<br>3. ANODE | STYLE 19:<br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE-ANODE | STYLE 20:<br>PIN 1. CATHODE<br>2. ANODE<br>3. GATE          |
| STYLE 21:<br>PIN 1. GATE<br>2. SOURCE<br>3. DRAIN       | STYLE 22:<br>PIN 1. RETURN<br>2. OUTPUT<br>3. INPUT   | STYLE 23:<br>PIN 1. ANODE<br>2. ANODE<br>3. CATHODE         | STYLE 24:<br>PIN 1. GATE<br>2. DRAIN<br>3. SOURCE           | STYLE 25:<br>PIN 1. ANODE<br>2. CATHODE<br>3. GATE          | STYLE 26:<br>PIN 1. CATHODE<br>2. ANODE<br>3. NO CONNECTION |
| STYLE 27:<br>PIN 1. CATHODE<br>2. CATHODE<br>3. CATHODE | STYLE 28:<br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE     |   |   |   |   |

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