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

# VHF/UHF Transistor

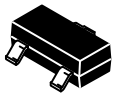
## NPN Silicon

### Features

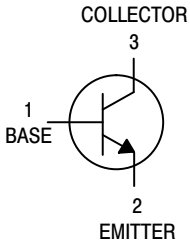
- S and NSV Prefixes for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

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**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 |

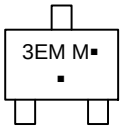
### THERMAL CHARACTERISTICS

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

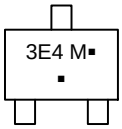
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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 (Pb−Free) | 3,000 / Tape & Reel |
| NSVMMBTH10LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| MMBTH10−4LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| MMBTH10LT3G, SMMBTH10−4LT3G | 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.

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**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Emitter Breakdown Voltage ($I_C$ = 1.0 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 25 | – | – | Vdc |
| Collector−Base Breakdown Voltage ($I_C$ = 100 μAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 30 | – | – | Vdc |
| Emitter−Base Breakdown Voltage ($I_E$ = 10 μAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 3.0 | – | – | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 25 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | – | 100 | nAdc |
| Emitter Cutoff Current ($V_{EB}$ = 2.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | – | – | 100 | nAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 4.0 mAdc, $V_{CE}$ = 10 Vdc) | $h_{FE}$ | | | | – |
| MMBTH10LT1G, NSVMMBTH10LT1G | | 60 | – | – | |
| MMBTH10−4LT1G, SMMBTH10−4LT3G | | 120 | – | 240 | |
| Collector−Emitter Saturation Voltage ($I_C$ = 4.0 mAdc, $I_B$ = 0.4 mAdc) | $V_{CE(sat)}$ | – | – | 0.5 | Vdc |
| Base−Emitter On Voltage ($I_C$ = 4.0 mAdc, $V_{CE}$ = 10 Vdc) | $V_{BE}$ | – | – | 0.95 | Vdc |
| **SMALL−SIGNAL CHARACTERISTICS** | | | | | |
| Current−Gain − Bandwidth Product ($I_C$ = 4.0 mAdc, $V_{CE}$ = 10 Vdc, f = 100 Mhz) | $f_T$ | | | | MHz |
| MMBTH10LT1G, NSVMMBTH10LT1G | | 650 | – | – | |
| MMBTH10−4LT1G, SMMBTH10−4LT3G | | 800 | – | – | |
| Collector−Base Capacitance ($V_{CB}$= 10 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{cb}$ | – | – | 0.7 | pF |
| Common−Base Feedback Capacitance ($V_{CB}$= 10 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{rb}$ | – | – | 0.65 | pF |
| Collector Base Time Constant ($I_C$= 4.0 mAdc, $V_{CB}$ = 10 Vdc, f = 31.8 MHz) | $rb'C_c$ | – | – | 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 Vdc, $I_C$ = 4.0 mAdc, $T_A$ = 25°C)

**$y_{ib}$, INPUT ADMITTANCE**

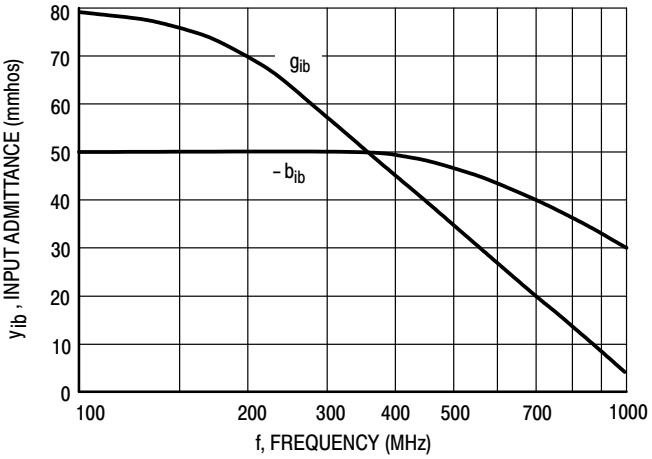



**Figure 1. Rectangular Form**

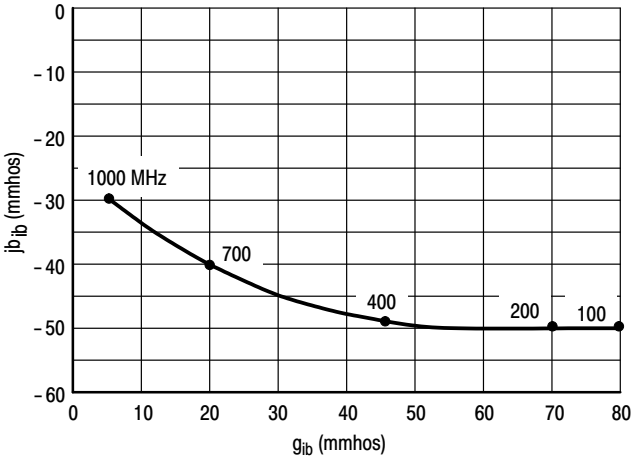



**Figure 2. Polar Form**

**$y_{fb}$, FORWARD TRANSFER ADMITTANCE**

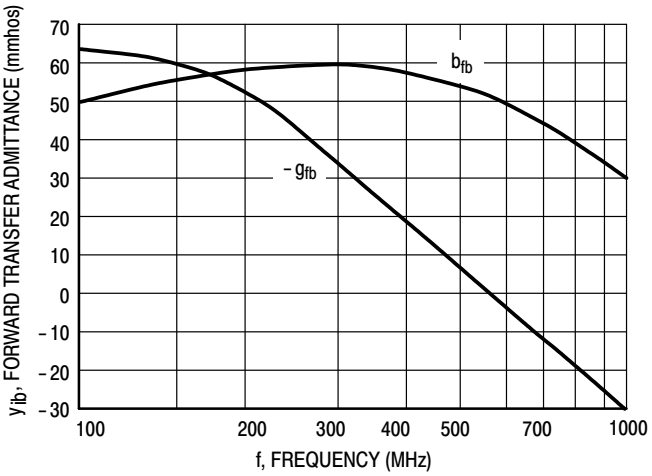



**Figure 3. Rectangular Form**

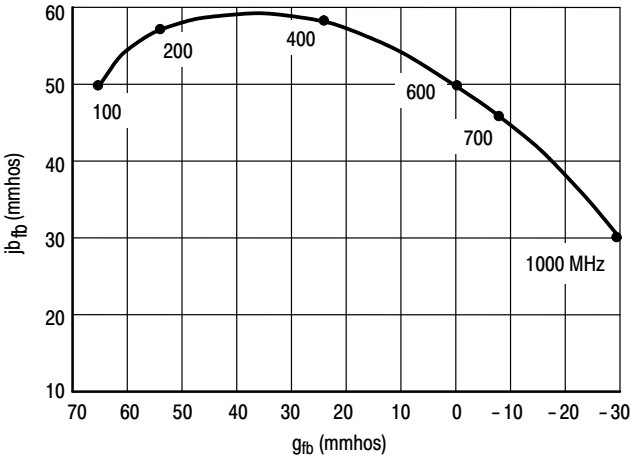



**Figure 4. Polar Form**

## TYPICAL CHARACTERISTICS

**COMMON−BASE y PARAMETERS versus FREQUENCY**
($V_{CB}$ = 10 Vdc, $I_C$ = 4.0 mAdc, $T_A$ = 25°C)

**$y_{rb}$, REVERSE TRANSFER ADMITTANCE**

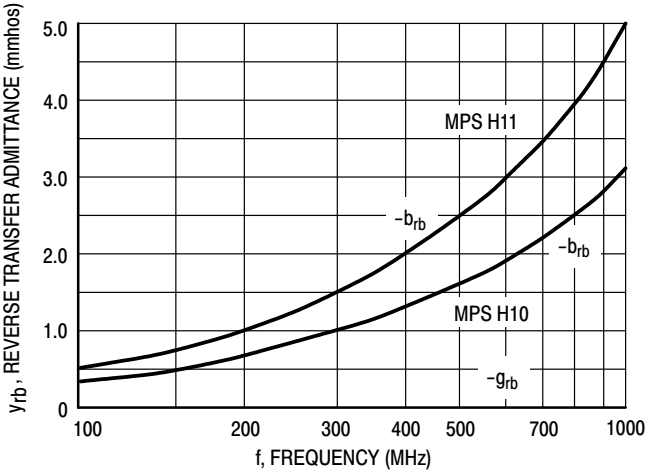



**Figure 5. Rectangular Form**

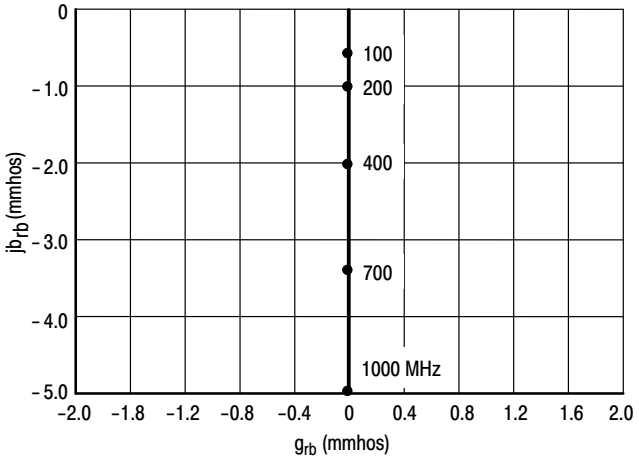



**Figure 6. Polar Form**

**$y_{ob}$, OUTPUT ADMITTANCE**

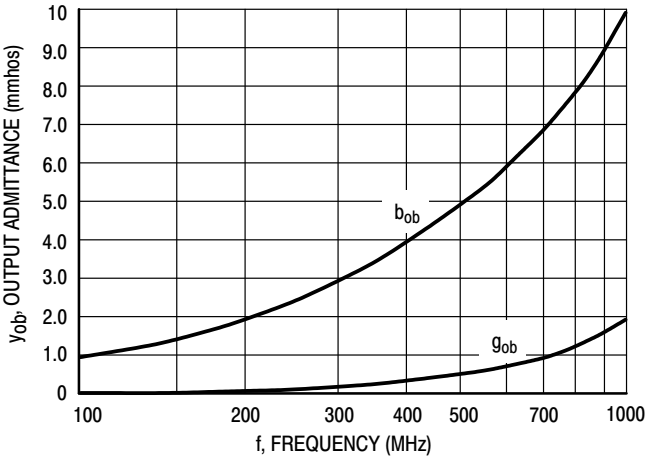



**Figure 7. Rectangular Form**

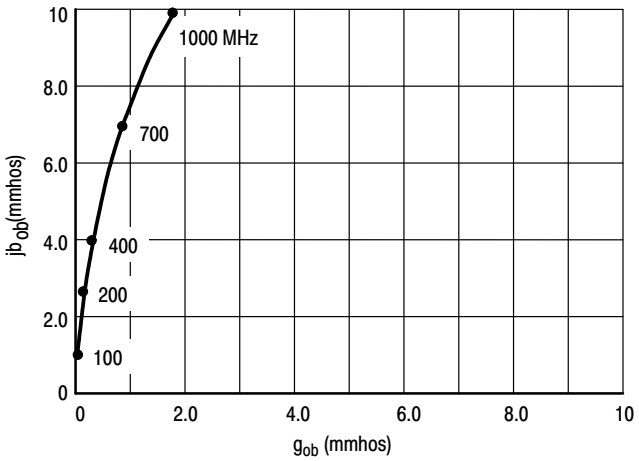
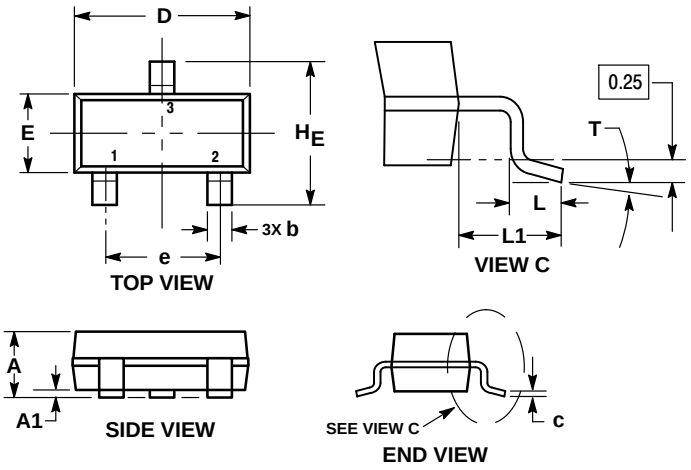



**Figure 8. Polar Form**

## PACKAGE DIMENSIONS

**SOT−23 (TO−236)**
CASE 318−08
ISSUE AR

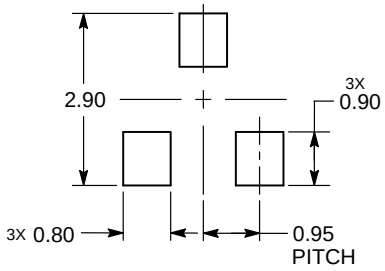



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | −−− | 10° | 0° | −−− | 10° |

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

## RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

*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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