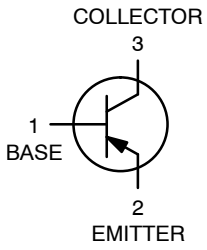
# PNP RF Transistor

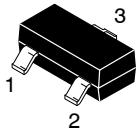
# MMBTH81

This device is designed for general RF amplifier and mixer applications to 250 MHz with collector currents in the 1.0 mA to 30 mA range. Sourced from Process 75.

### Features

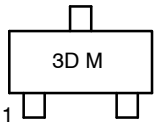
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable




**SOT−23**
**CASE 318−08**
**STYLE 6**

### MARKING DIAGRAM




3D = Specific Device Code
M = Date Code*

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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

**MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Units |
|---|---|---|---|
| Collector − Emitter Voltage | $V_{CEO}$ | 20 | V |
| Collector − Base Voltage | $V_{CBO}$ | 20 | V |
| Emitter − Base Voltage | $V_{EBO}$ | 3.0 | V |
| Collector Current − Continuous | $I_C$ | 50 | mA |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

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

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation<br>Derate above 25°C | $P_D$ | 225<br>1.8 | mW<br>mW/°C |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 556 | °C/W |

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. Device mounted on FR−4 PCB 1.6 × 1.6 × 0.06 in.
2. These ratings are based on a maximum junction temperature of 150°C.
3. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
4. All voltages (V) and currents (A) are negative polarity for PNP transistors.



May, 2024 − Rev. 2
Publication Order Number:
MMBTH81/D

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

| Symbol | Parameter | Test Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| $V_{(BR)CEO}$ | Collector – Emitter Breakdown Voltage (Note 5) | $I_C$ = 1.0 mA, $I_B$ = 0 | 20 | | V |
| $V_{(BR)CBO}$ | Collector – Base Breakdown Voltage | $I_C$ = 10 μA, $I_E$ = 0 | 20 | | V |
| $V_{(BR)EBO}$ | Emitter – Base Breakdown Voltage | $I_E$ = 10 μA, $I_C$ = 0 | 3.0 | | V |
| $I_{CBO}$ | Collector Cutoff Current | $V_{CB}$ = 10 V, $I_E$ = 0 | | 100 | nA |
| $I_{EBO}$ | Emitter Cutoff Current | $V_{EB}$ = 2.0 V, $I_C$ = 0 | | 100 | nA |
| **ON CHARACTERISTICS** | | | | | |
| $h_{FE}$ | DC Current Gain | $I_C$ = 5.0 mA, $V_{CE}$ = 10 V | 60 | | |
| $V_{CE(sat)}$ | Collector – Emitter Saturation Voltage | $I_C$ = 5.0 mA, $I_B$ = 0.5 mA | | 0.5 | V |
| $V_{BE(sat)}$ | Base – Emitter Saturation Voltage | $I_C$ = 5.0 mA, $V_{CE}$ = 10 V | | 0.9 | V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | |
| $f_T$ | Current Gain – Bandwidth Product | $I_C$ = 5.0 mA, $V_{CE}$ = 10 V, f = 100 MHz | 600 | | MHz |
| $C_{cb}$ | Collector–Base Capacitance | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1.0 MHz | | 0.85 | pF |
| $C_{ce}$ | Collector Emitter Capacitance | $V_{CB}$ = 10 V, $I_B$ = 0, f = 1.0 MHz | | 0.65 | pF |

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.

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

## SPICE MODEL

PNP(Is=10f Xti=3 Eg=1.11 Vaf=100 Bf=133.8 Ise=1.678p Ne=2.159 Ikf=.1658 Nk=.901 Xtb=1.5 Var=100 Br=1 Isc=9.519n Nc=3.88 Ikr=5.813 Rc=7.838 Cjc=2.81p Mjc=.1615 Vjc=.8282 Fc=.5 Cje=2.695p Mje=.3214 Vje=.7026 Tr=11.32n Tf=97.83p Itf=69.29 Xtf=599u Vtf=10)

## ORDERING INFORMATION

| Device | Specific Marking Code | Package | Shipping† |
|---|---|---|---|
| NSVMMBTH81LT1G* | 3D | SOT–23 (Pb–Free) | 3,000 / Tape & Reel |
| NSVMMBTH81LT3G* | 3D | 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.

*NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q101 Qualified and PPAP Capable.

## TYPICAL CHARACTERISTICS

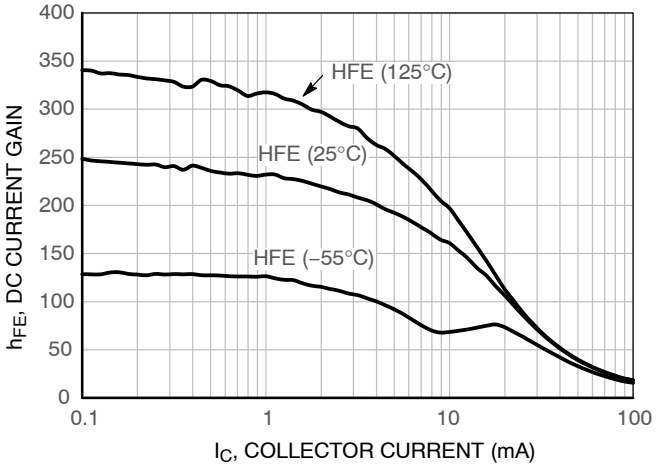



**Figure 1. DC Current Gain vs. Collector Current**

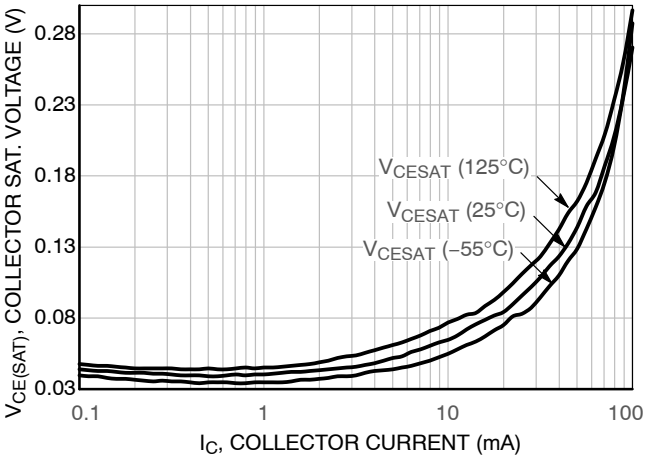



**Figure 2. Collector Saturation Voltage vs. Collector Current**

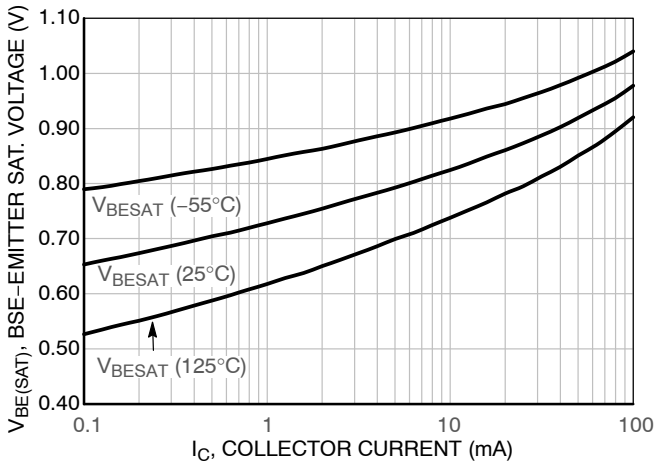



**Figure 3. Base−Emitter Saturation Voltage vs. Collector Current**

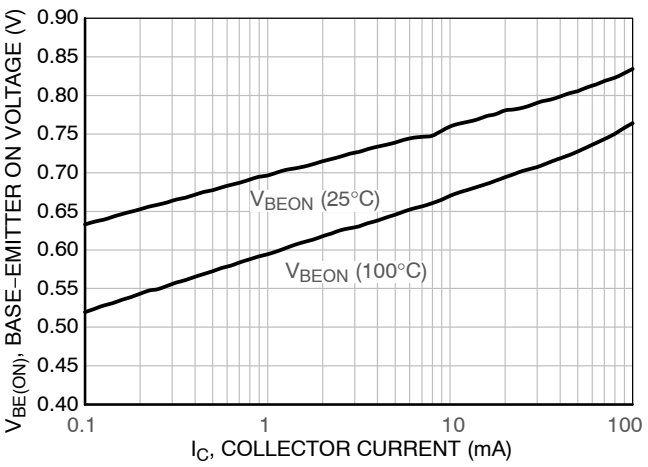



**Figure 4. Base−Emitter ON Voltage vs. Collector Current**

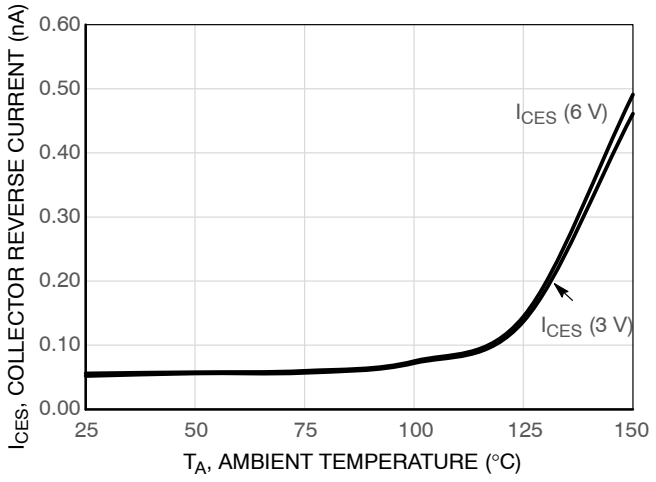



**Figure 5. Collector Reverse Current vs. Ambient Temperature**

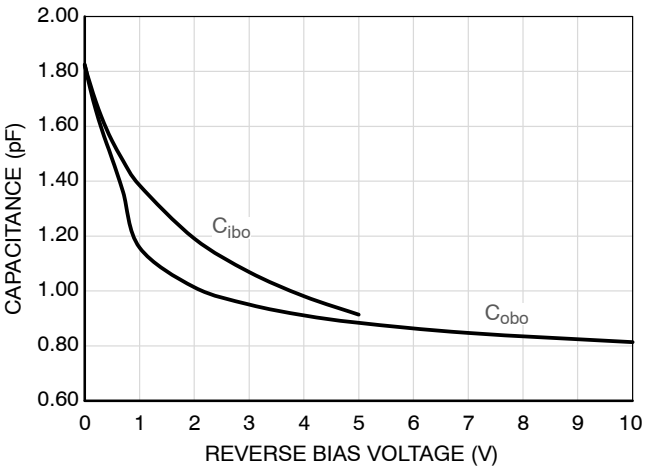
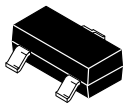


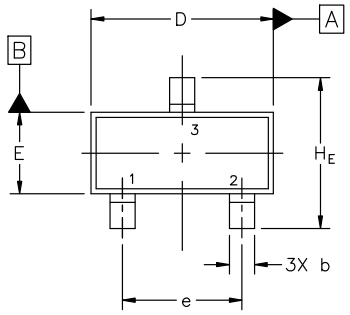

**Figure 6. Input /Output Capacitance vs. Reverse Bias Voltage**



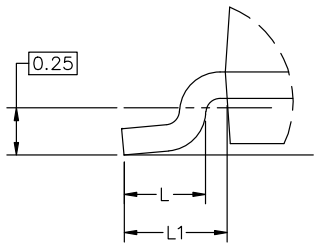
**SCALE 4:1**

**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**
CASE 318
ISSUE AU

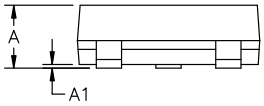
DATE 14 AUG 2024



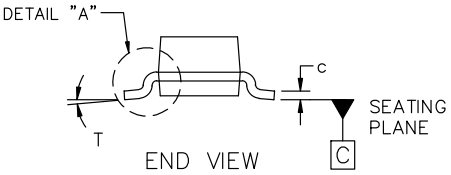

TOP VIEW




DETAIL "A"
Scale 3:1




SIDE VIEW

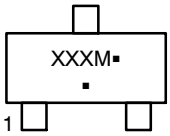



END VIEW

| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.37 | 0.44 | 0.50 |
| c | 0.08 | 0.14 | 0.20 |
| D | 2.80 | 2.90 | 3.04 |
| E | 1.20 | 1.30 | 1.40 |
| e | 1.78 | 1.90 | 2.04 |
| L | 0.30 | 0.43 | 0.55 |
| L1 | 0.35 | 0.54 | 0.69 |
| $H_E$ | 2.10 | 2.40 | 2.64 |
| T | 0° | −−− | 10° |

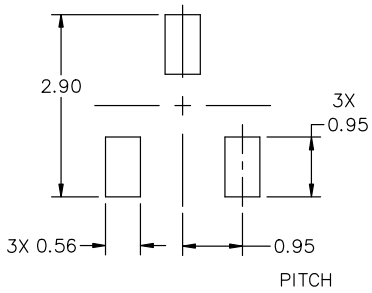
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

**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 onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42226B** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **SOT−23 (TO−236) 2.90x1.30x1.00 1.90P** | | **PAGE 1 OF 2** |

**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**
CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

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

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
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