

# 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

#### 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) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 1)	$R_{\theta JA}$	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 (Note 2)	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +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 =  $1.0 \times 0.75 \times 0.062$  in.
2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina

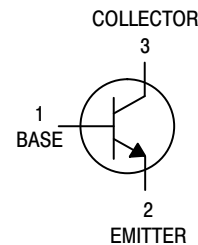


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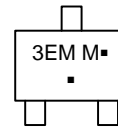
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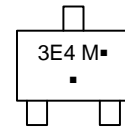
SOT-23 (TO-236)  
CASE 318  
STYLE 6



#### 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.

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

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

### ON CHARACTERISTICS

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

### SMALL-SIGNAL CHARACTERISTICS

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

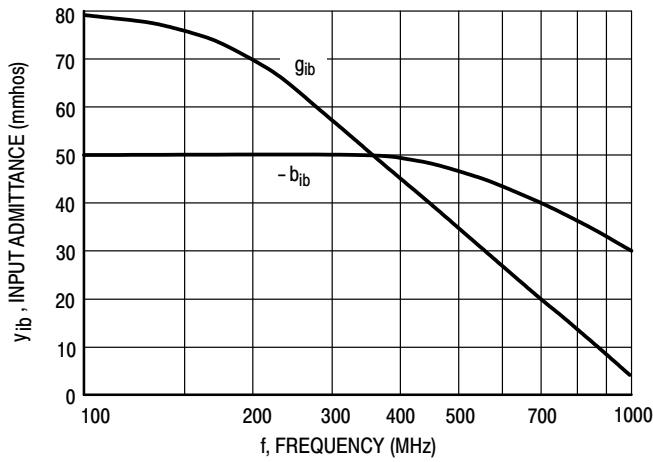


Figure 1. Rectangular Form

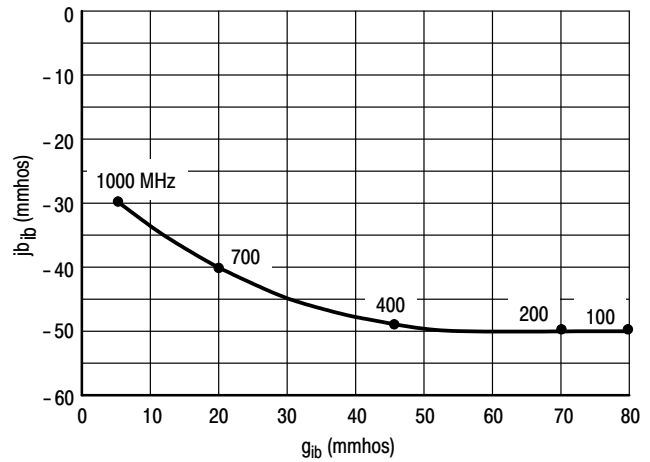


Figure 2. Polar Form

$y_{fb}$ , FORWARD TRANSFER ADMITTANCE

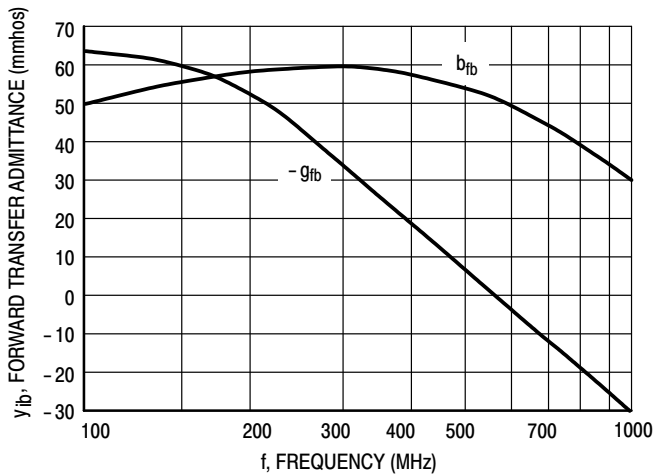


Figure 3. Rectangular Form

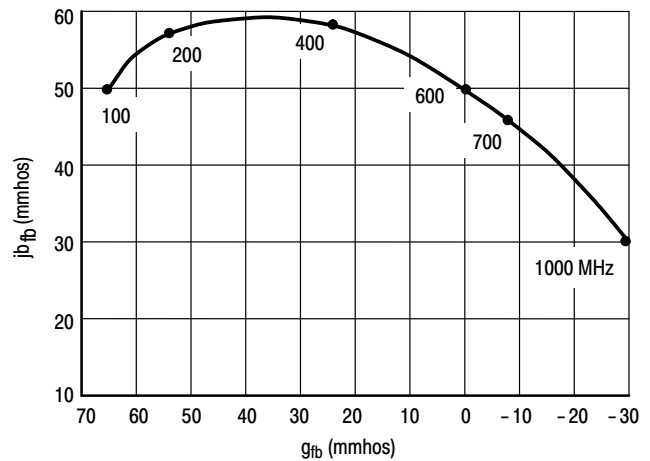


Figure 4. Polar Form

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

## TYPICAL CHARACTERISTICS

### COMMON-BASE $y$ PARAMETERS versus FREQUENCY

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

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

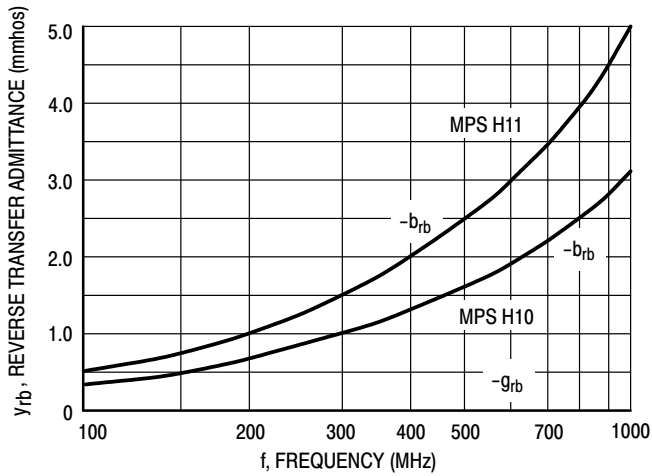


Figure 5. Rectangular Form

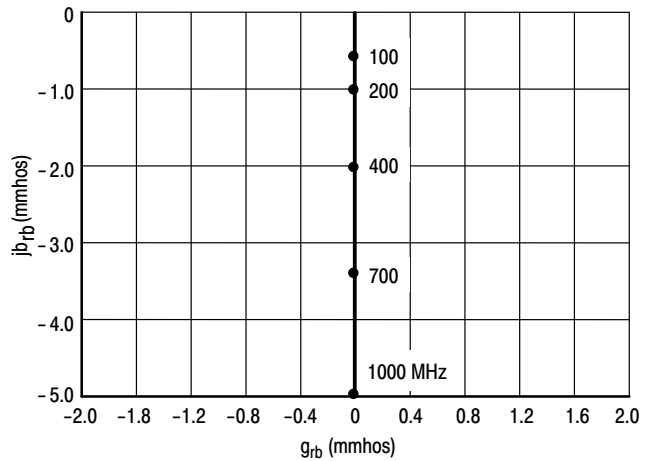


Figure 6. Polar Form

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

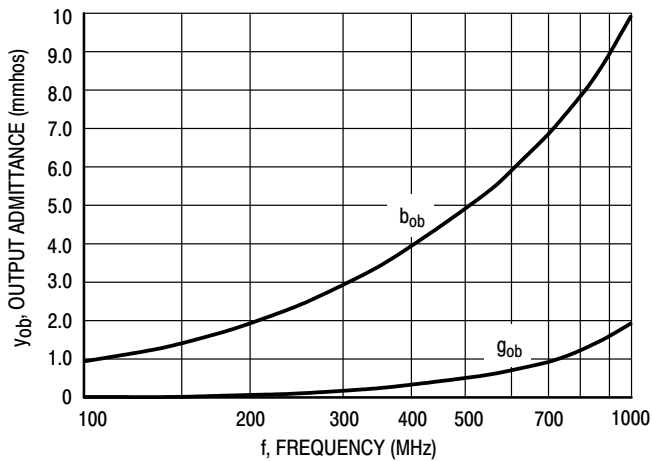


Figure 7. Rectangular Form

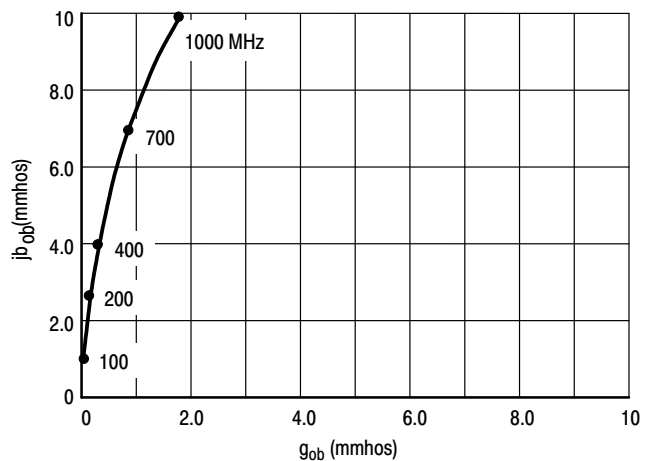
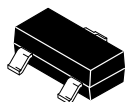


Figure 8. Polar Form

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

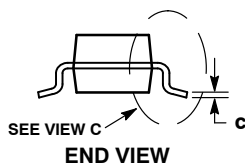
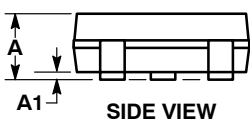
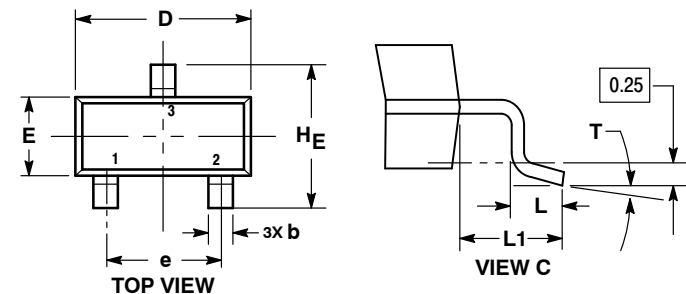
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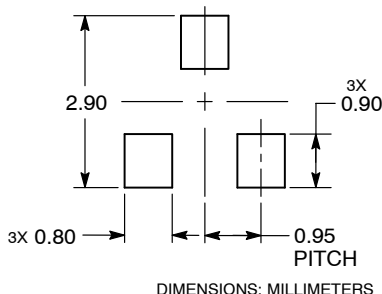
**SOT-23 (TO-236)**  
CASE 318-08  
ISSUE AS

DATE 30 JAN 2018

SCALE 4:1



### RECOMMENDED SOLDERING FOOTPRINT

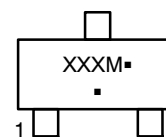


**NOTES:**

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
HE	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.

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

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