NPN General Purpose Transistor

The MMBT2222AM3T5G device is a spin-off of our popular SOT-23 three-leaded device. It is designed for general purpose amplifier applications and is housed in the SOT-723 surface mount package. This device is ideal for low-power surface mount applications where board space is at a premium.

Features

- Reduces Board Space
- NSV Prefix 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}	40	Vdc
Collector - Base Voltage	V _{CBO}	75	Vdc
Emitter – Base Voltage	V _{EBO}	6.0	Vdc
Collector Current – Continuous	Ic	600	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 1) T _A = 25°C Derate above 25°C	P _D	265 2.1	mW mW/°C
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	470	°C/W
Total Device Dissipation Alumina Substrate, (Note 2) T _A = 25°C Derate above 25°C	P _D	640 5.1	mW mW/°C
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	195	°C/W
Junction and Storage Temperature	T _J , T _{stg}	-55 to +150	°C

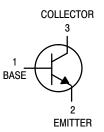
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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



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MARKING DIAGRAM

SOT-723 CASE 631AA STYLE 1



AA M Specific Device CodeDate Code

ORDERING INFORMATION

Device	Package	Shipping [†]
MMBT2222AM3T5G	SOT-723 (Pb-Free)	8000/Tape & Reel
NSVMMBT2222AM3T5G	SOT-723 (Pb-Free)	8000/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.

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

Character	istic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (I _C = 10) mAdc, I _B = 0)	V _{(BR)CEO}	40	_	Vdc
Collector – Base Breakdown Voltage ($I_C = 10 \mu Adc, I_E = 0$)			75	_	Vdc
Emitter – Base Breakdown Voltage ($I_E = 10 \mu Adc, I_C = 0$)			6.0	_	Vdc
Collector Cutoff Current (V _{CE} = 60 Vdc, V _{EB(of}	I _{CEX}	-	10	nAdc	
Collector Cutoff Current		I _{CBO}	_ _	0.01 10	μAdc
Emitter Cutoff Current ($V_{EB} = 3.0 \text{ Vdc}$, $I_{C} = 0$)		I _{EBO}	-	100	nAdc
Base Cutoff Current (V _{CE} = 60 Vdc, V _{EB(off)} =	3.0 Vdc)	I _{BL}	-	20	nAdc
ON CHARACTERISTICS					
$\begin{array}{l} \text{DC Current Gain} \\ (I_C = 0.1 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 1.0 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 10 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 10 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 10 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 150 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (I_C = 150 \text{ mAdc, V}_{CE} = 1.0 \text{ Vdc}) \\ (I_C = 500 \text{ mAdc, V}_{CE} = 10 \text{ Vdc}) \\ (Notice = 10$	te 3)	hFE	35 50 75 35 100 50 40	- - - 300 - -	-
Collector – Emitter Saturation Voltage (Note 3) ($I_C = 150 \text{ mAdc}$, $I_B = 15 \text{ mAdc}$) ($I_C = 500 \text{ mAdc}$, $I_B = 50 \text{ mAdc}$)		V _{CE(sat)}	_ _	0.3 1.0	Vdc
Base – Emitter Saturation Voltage (Note 3) ($I_C = 150 \text{ mAdc}$, $I_B = 15 \text{ mAdc}$) ($I_C = 500 \text{ mAdc}$, $I_B = 50 \text{ mAdc}$)		V _{BE(sat)}	0.6 -	1.2 2.0	Vdc
SMALL-SIGNAL CHARACTERISTICS					
$\label{eq:current-Gain-Bandwidth Product (Note 4)} Current-Gain-Bandwidth Product (Note 4) \\ (I_C = 20 \text{ mAdc}, V_{CE} = 20 \text{ Vdc}, f = 10 \text{ MHz}) \\$	00 MHz)	f⊤	300	_	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1.0 MHz)		C _{obo}	-	8.0	pF
Input Capacitance ($V_{EB} = 0.5 \text{ Vdc}$, $I_{C} = 0$, $f = 1$	C _{ibo}	-	25	pF	
Input Impedance (I _C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1. (I _C = 10 mAdc, V_{CE} = 10 Vdc, f = 1.		h _{ie}	2.0 0.25	8.0 1.25	kΩ
Voltage Feedback Ratio $ \begin{array}{l} \text{(I}_{\text{C}} = 1.0 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc, f} = 1.0 \text{ kHz)} \\ \text{(I}_{\text{C}} = 10 \text{ mAdc, V}_{\text{CE}} = 10 \text{ Vdc, f} = 1.0 \text{ kHz)} \end{array} $		h _{re}	_ _	8.0 4.0	X 10 ⁻⁴
Small – Signal Current Gain ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$)		h _{fe}	50 75	300 375	-
Output Admittance ($I_C = 1.0 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$) ($I_C = 10 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$)		h _{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant ($I_E = 20 \text{ mAdc}, V_{CB} = 20 \text{ Vdc}, f = 31.8 \text{ MHz}$)		rb, C _c	_	150	ps
Noise Figure (I _C = 100 μ Adc, V _{CE} = 10 Vdc, R _S = 1.0 k Ω , f = 1.0 kHz)		NF	_	4.0	dB
SWITCHING CHARACTERISTICS					
Delay Time	$(V_{CC} = 30 \text{ Vdc}, V_{BE(off)} = -0.5 \text{ Vdc},$	t _d	-	10	
Rise Time	$I_C = 150 \text{ mAdc}, I_{B1} = 15 \text{ mAdc})$	t _r	-	25	ns
Storage Time	$(V_{CC} = 30 \text{ Vdc}, I_{C} = 150 \text{ mAdc},$	t _S	_	225	ne
Fall Time $I_{B1} = I_{B2} = 15 \text{ mAdc}$		t _f	_	60	ns

^{3.} Pulse Test: Pulse Width $\leq 300~\mu s$, Duty Cycle $\leq 2.0\%$. 4. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

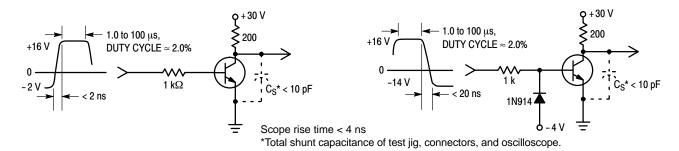


Figure 1. Turn-On Time

Figure 2. Turn-Off Time

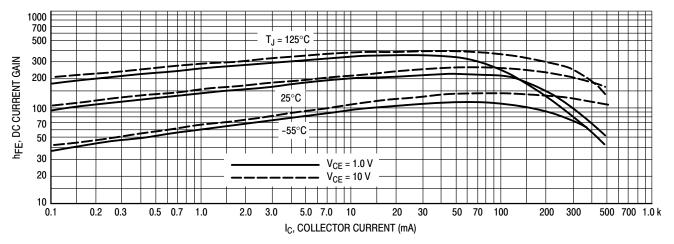


Figure 3. DC Current Gain

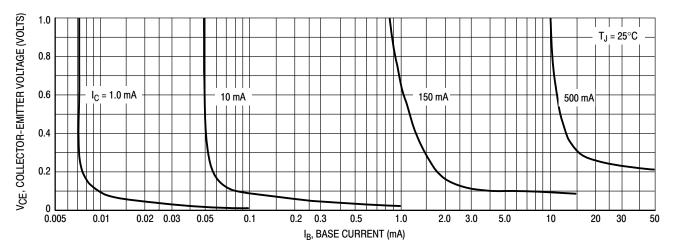


Figure 4. Collector Saturation Region

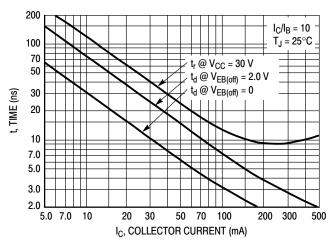


Figure 5. Turn-On Time

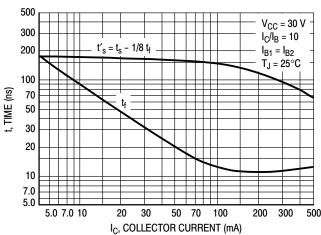


Figure 6. Turn-Off Time

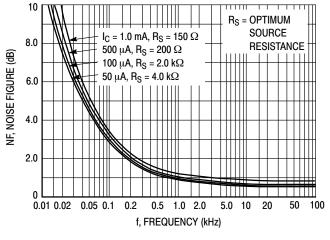


Figure 7. Frequency Effects

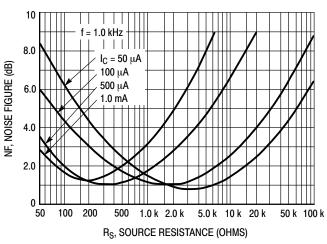


Figure 8. Source Resistance Effects

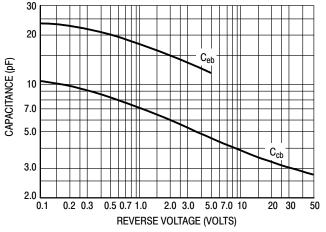


Figure 9. Capacitances

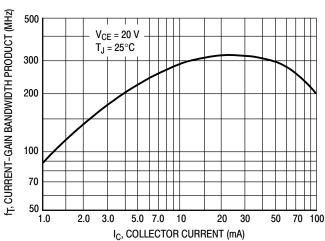
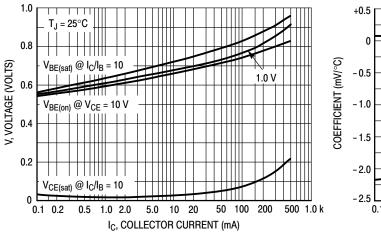


Figure 10. Current-Gain Bandwidth Product



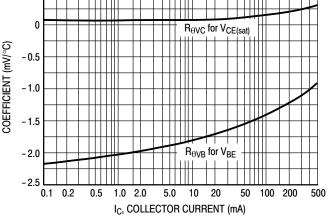


Figure 11. "On" Voltages

Figure 12. Temperature Coefficients



SOT-723 CASE 631AA-01 ISSUE D

DATE 10 AUG 2009

NOTES:

- 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 BASE MATERIAL.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

	MILLIMETERS		
DIM	MIN	NOM	MAX
Α	0.45	0.50	0.55
b	0.15	0.21	0.27
b1	0.25	0.31	0.37
С	0.07	0.12	0.17
D	1.15	1.20	1.25
E	0.75	0.80	0.85
е	0.40 BSC		
ΗE	1.15	1.20	1.25
L	0.29 REF		
12	0.15	0.20	0.25

L2 0.15 0.20 0.25

GENERIC MARKING DIAGRAM*

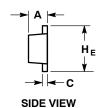


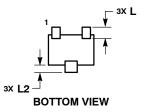
= Specific Device Code XX Μ

= Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G", may or not be present.

-X-2X b ⊕ 0.08 X Y **TOP VIEW**

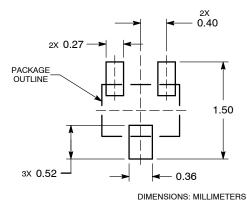




STYLE 1: PIN 1. BASE 2. EMITTER 3. COLLECTOR STYLE 2: PIN 1. ANODE 2. N/C 3. CATHODE STYLE 3: PIN 1. ANODE 2. ANODE 3. CATHODE

STYLE 4: PIN 1. CATHODE 2. CATHODE 3. ANODE STYLE 5: PIN 1. GATE 2. SOURCE 3. DRAIN

RECOMMENDED 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.

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