



**THE DATASHEET OF
MMBT2222AM3T5G**

MMBT2222AM3T5G

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	I_C	600	mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 1) $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	265 2.1	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	470	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, (Note 2) $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	640 5.1	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	195	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{stg}	–55 to +150	$^\circ\text{C}$

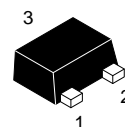
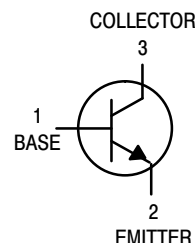
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.



ON Semiconductor®

www.onsemi.com



MARKING DIAGRAM

SOT-723
CASE 631AA
STYLE 1



AA = Specific Device Code
M = Date 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.

MMBT2222AM3T5G

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

Characteristic	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 μAdc, I _E = 0)	V _{(BR)CBO}	75	–	Vdc
Emitter – Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	6.0	–	Vdc
Collector Cutoff Current (V _{CE} = 60 Vdc, V _{EB(off)} = 3.0 Vdc)	I _{CEX}	–	10	nAdc
Collector Cutoff Current (V _{CB} = 60 Vdc, I _E = 0) (V _{CB} = 60 Vdc, I _E = 0, T _A = 125°C)	I _{CB0}	– –	0.01 10	μAdc
Emitter Cutoff Current (V _{EB} = 3.0 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

DC Current Gain (I _C = 0.1 mAdc, V _{CE} = 10 Vdc) (I _C = 1.0 mAdc, V _{CE} = 10 Vdc) (I _C = 10 mAdc, V _{CE} = 10 Vdc) (I _C = 10 mAdc, V _{CE} = 10 Vdc, T _A = –55°C) (I _C = 150 mAdc, V _{CE} = 10 Vdc) (Note 3) (I _C = 150 mAdc, V _{CE} = 1.0 Vdc) (Note 3) (I _C = 500 mAdc, V _{CE} = 10 Vdc) (Note 3)	h _{FE}	35 50 75 35 100 50 40	– – – – 300 – –	–
Collector – Emitter Saturation Voltage (Note 3) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{CE(sat)}	– –	0.3 1.0	Vdc
Base – Emitter Saturation Voltage (Note 3) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	V _{BE(sat)}	0.6 –	1.2 2.0	Vdc

SMALL – SIGNAL CHARACTERISTICS

Current – Gain – Bandwidth Product (Note 4) (I _C = 20 mAdc, V _{CE} = 20 Vdc, f = 100 MHz)	f _T	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 Vdc, I _C = 0, f = 1.0 MHz)	C _{ibo}	–	25	pF
Input Impedance (I _C = 1.0 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz) (I _C = 10 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz)	h _{ie}	2.0 0.25	8.0 1.25	kΩ
Voltage Feedback Ratio (I _C = 1.0 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz) (I _C = 10 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz)	h _{re}	– –	8.0 4.0	X 10 ^{–4}
Small – Signal Current Gain (I _C = 1.0 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz) (I _C = 10 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz)	h _{fe}	50 75	300 375	–
Output Admittance (I _C = 1.0 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz) (I _C = 10 mAdc, V _{CE} = 10 Vdc, f = 1.0 kHz)	h _{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant (I _E = 20 mAdc, V _{CB} = 20 Vdc, f = 31.8 MHz)	r _b , C _c	–	150	ps
Noise Figure (I _C = 100 μAdc, V _{CE} = 10 Vdc, R _S = 1.0 kΩ, f = 1.0 kHz)	NF	–	4.0	dB

SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = 30 Vdc, V _{BE(off)} = –0.5 Vdc, I _C = 150 mAdc, I _{B1} = 15 mAdc)	t _d	–	10	ns
Rise Time		t _r	–	25	
Storage Time	(V _{CC} = 30 Vdc, I _C = 150 mAdc, I _{B1} = I _{B2} = 15 mAdc)	t _s	–	225	ns
Fall Time		t _f	–	60	

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

4. f_T is defined as the frequency at which |h_{fe}| extrapolates to unity.

MMBT222AM3T5G

SWITCHING TIME EQUIVALENT TEST CIRCUITS

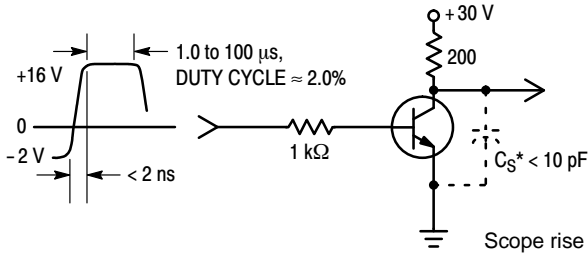


Figure 1. Turn-On Time

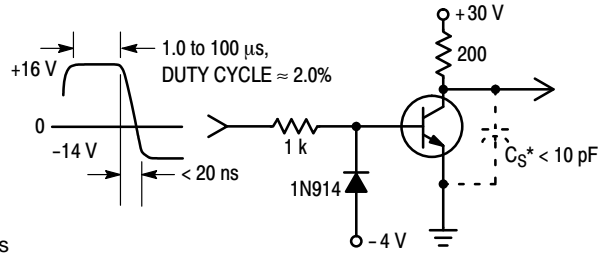


Figure 2. Turn-Off Time

Scope rise time < 4 ns
 *Total shunt capacitance of test jig, connectors, and oscilloscope.

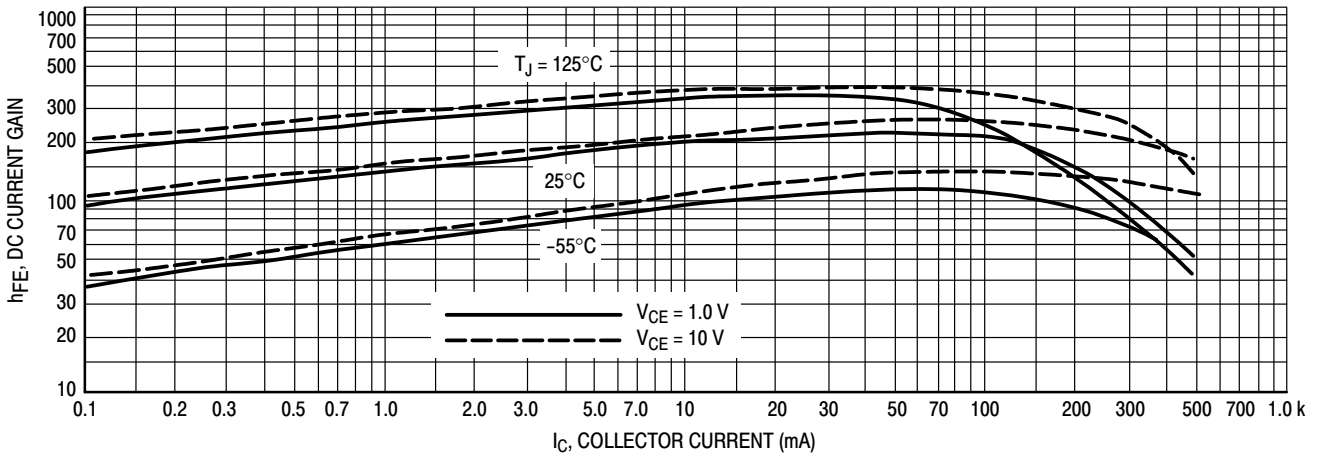


Figure 3. DC Current Gain

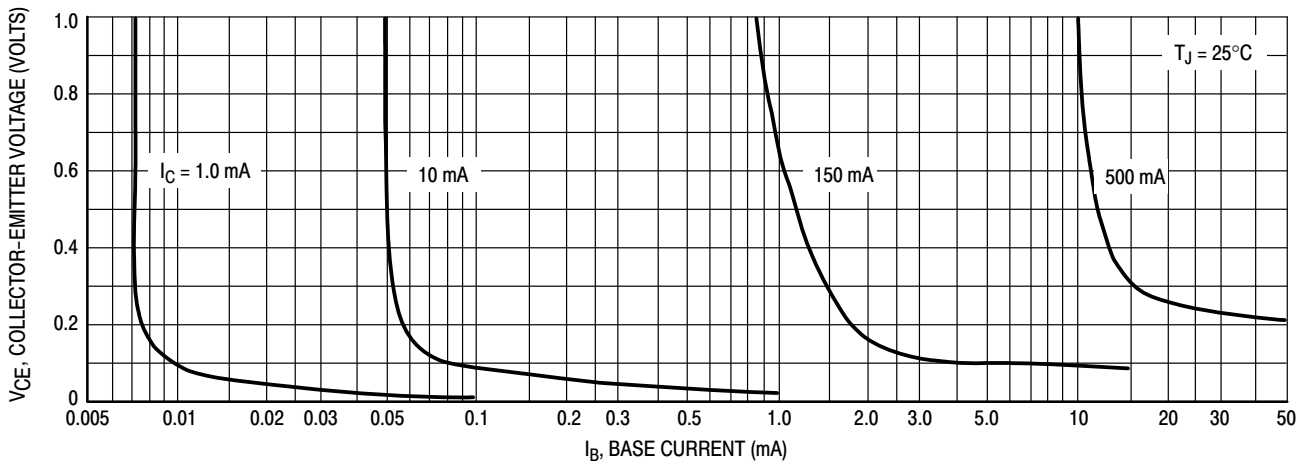


Figure 4. Collector Saturation Region

MMBT222AM3T5G

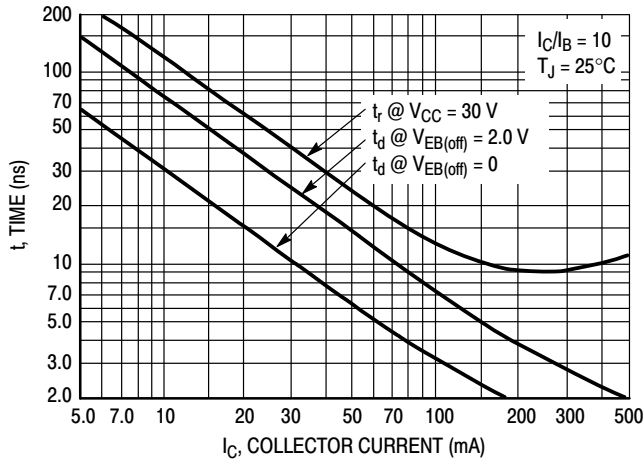


Figure 5. Turn-On Time

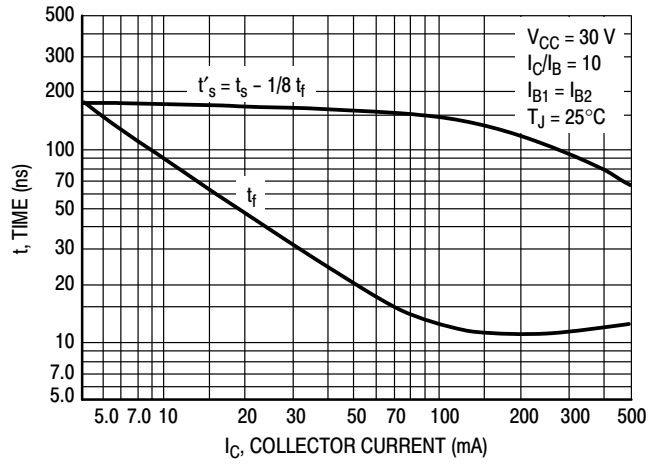


Figure 6. Turn-Off Time

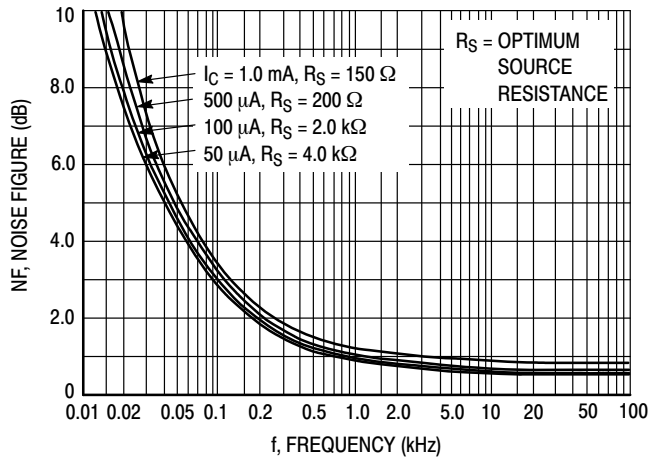


Figure 7. Frequency Effects

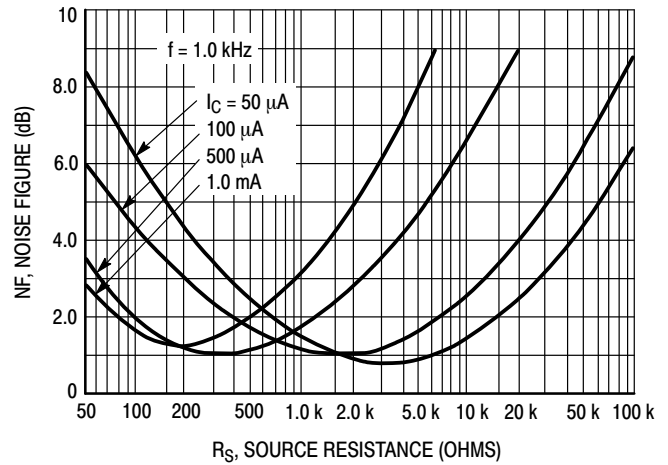


Figure 8. Source Resistance Effects

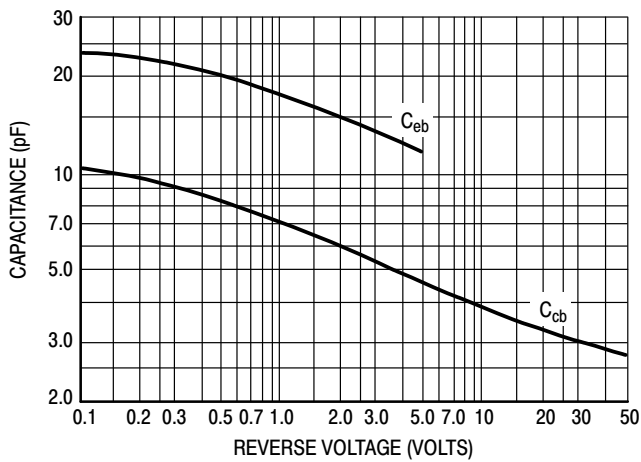


Figure 9. Capacitances

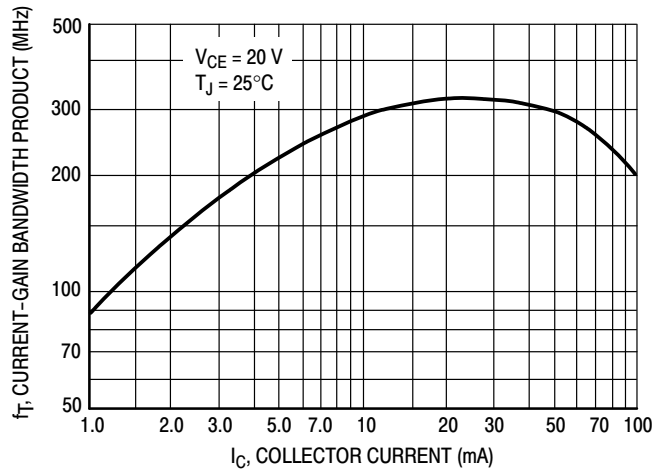


Figure 10. Current-Gain Bandwidth Product

MMBT222AM3T5G

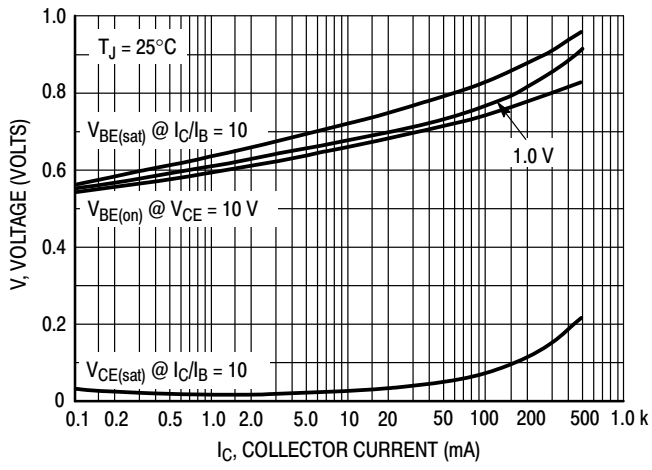


Figure 11. "On" Voltages

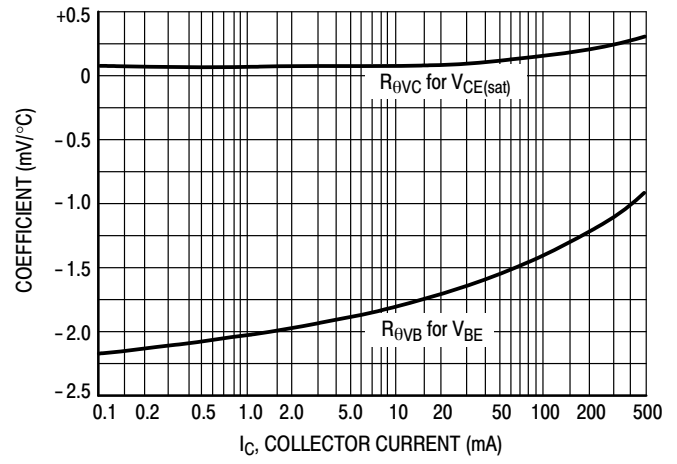
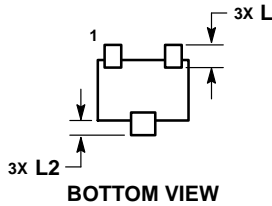
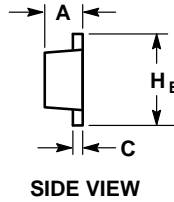
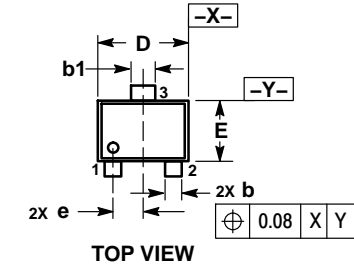


Figure 12. Temperature Coefficients

MMBT2222AM3T5G

PACKAGE DIMENSIONS

SOT-723
CASE 631AA
ISSUE D



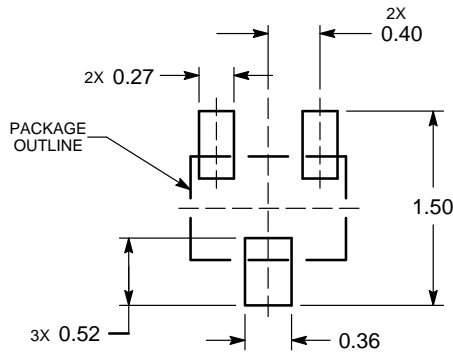
NOTES:

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.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
b	0.15	0.21	0.27
b1	0.25	0.31	0.37
C	0.07	0.12	0.17
D	1.15	1.20	1.25
E	0.75	0.80	0.85
e	0.40 BSC		
H E	1.15	1.20	1.25
L	0.29 REF		
L2	0.15	0.20	0.25

STYLE 1:
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.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

⊖ [View MMBT2222AM3T5G on WIN SOURCE](#)

⊖ [ON Semiconductor](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

- ✓ Global Sourcing Solution
- ✓ Obsolete Management
- ✓ Cost Control Management
- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management