MMBT2222AWT1

Preferred Device

General Purpose Transistor

NPN Silicon

These transistors are designed for general purpose amplifier applications. They are housed in the SOT−323/SC−70 package which is designed for low power surface mount applications.

Features

- Pb−Free Package is Available

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 T_A = 25°C	P_D	150	mW
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	833	°C/W
Junction and Storage Temperature	T_J, T_{stg}	−55 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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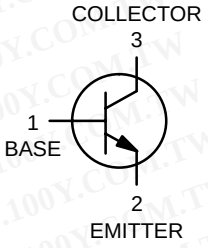
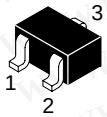
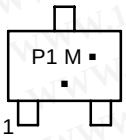




SC−70
CASE 419
STYLE 3

MARKING DIAGRAM



P1 = Specific Device Code
M = Date Code*
▪ = Pb−Free Package
(Note: Microdot may be in either location)
*Date Code orientation may vary depending upon manufacturing location.

ORDERING INFORMATION

Device	Package	Shipping†
MMBT2222AWT1	SC−70	3000/Tape & Reel
MMBT2222AWT1G	SC−70 (Pb−Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector−Emitter Breakdown Voltage (Note 1) (I_C = 1.0 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
Base Cutoff Current (V_{CE} = 60 Vdc, V_{EB} = 3.0 Vdc)	I_{BL}	−	20	nAdc
Collector Cutoff Current (V_{CE} = 60 Vdc, V_{EB} = 3.0 Vdc)	I_{CEX}	−	10	nAdc
ON CHARACTERISTICS (Note 1)				
DC Current Gain (Note 1) (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 = 150 mAdc, V_{CE} = 10 Vdc) (I_C = 500 mAdc, V_{CE} = 10 Vdc)	H_{FE}	 35 50 75 100 40	 − − − 300 −	−
Collector−Emitter Saturation Voltage (Note 1) (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 1) (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 (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}	−	30	pF
Input Impedance (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)	h_{ie}	0.25	1.25	kΩ
Voltage Feedback Ratio (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)	h_{re}	−	4.0	X 10^{-4}
Small−Signal Current Gain (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)	h_{fe}	75	375	−
Output Admittance (V_{CE} = 10 Vdc, I_C = 10 mAdc, f = 1.0 kHz)	h_{oe}	25	200	μmhos
Noise Figure (V_{CE} = 10 Vdc, I_C = 100 μAdc, R_S = 1.0 kΩ, f = 1.0 kHz)	NF	−	4.0	dB
SWITCHING CHARACTERISTICS				
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = −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	

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

SWITCHING TIME EQUIVALENT TEST CIRCUITS

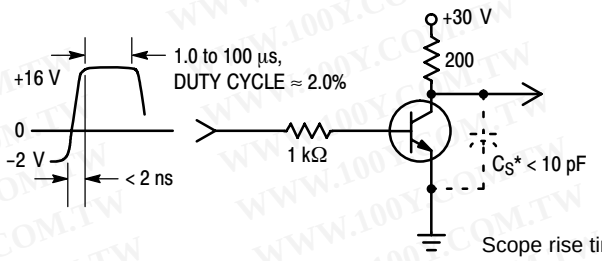


Figure 1. Turn−On Time

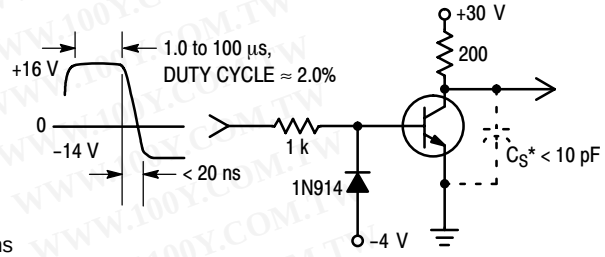


Figure 2. Turn−Off Time

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

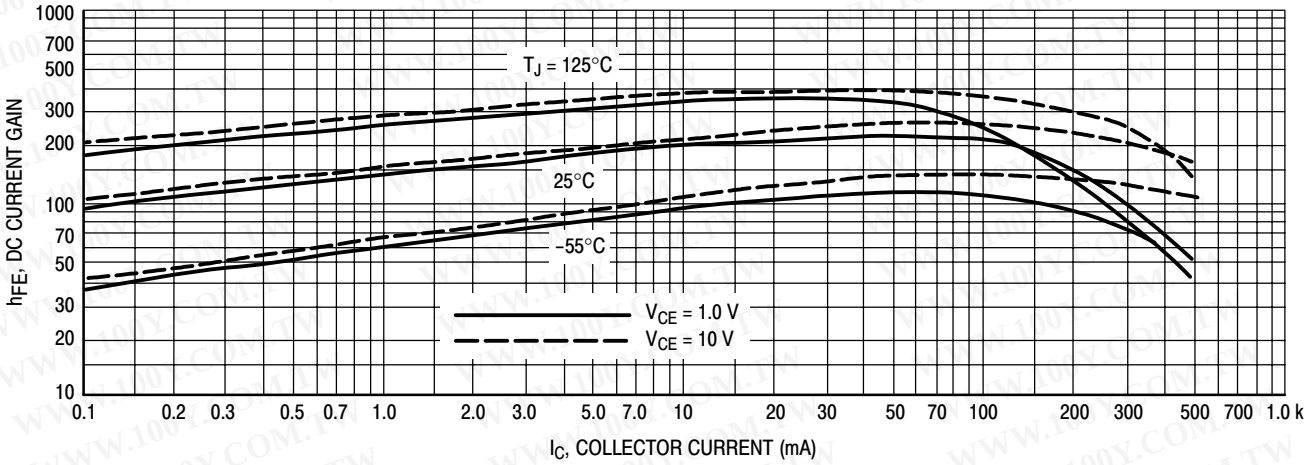


Figure 3. DC Current Gain

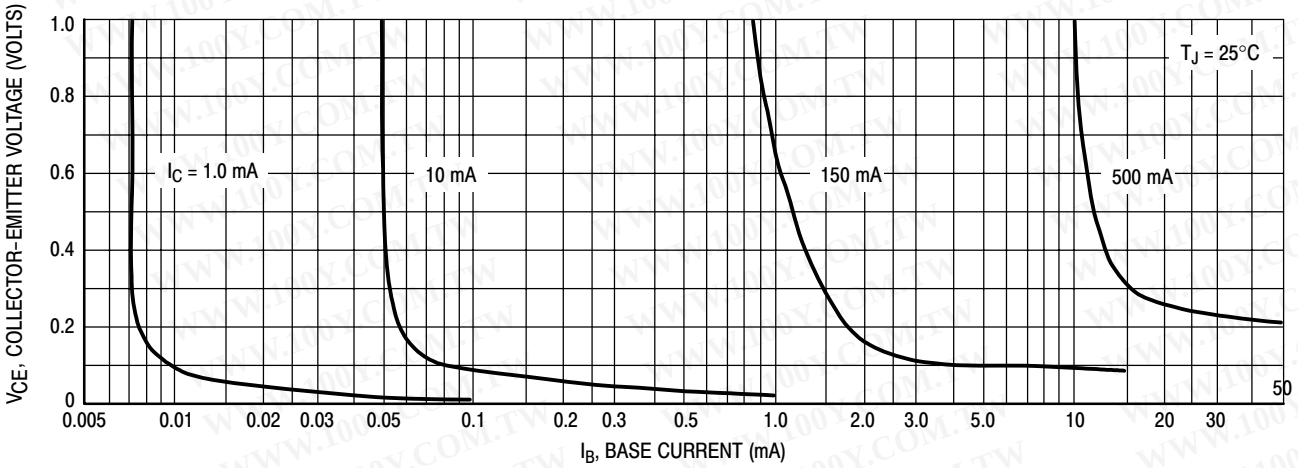


Figure 4. Collector Saturation Region

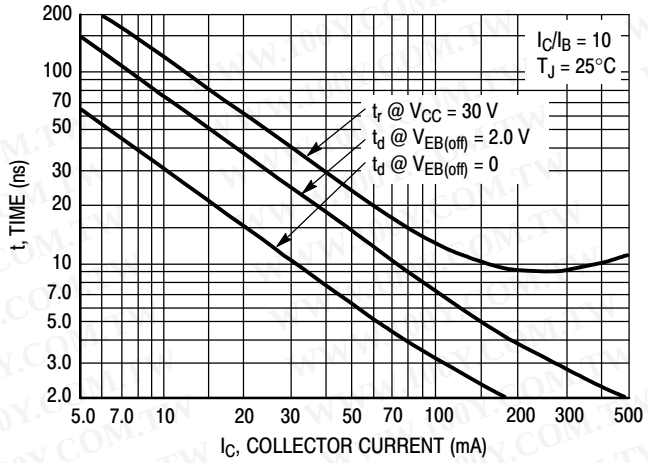


Figure 5. Turn−On Time

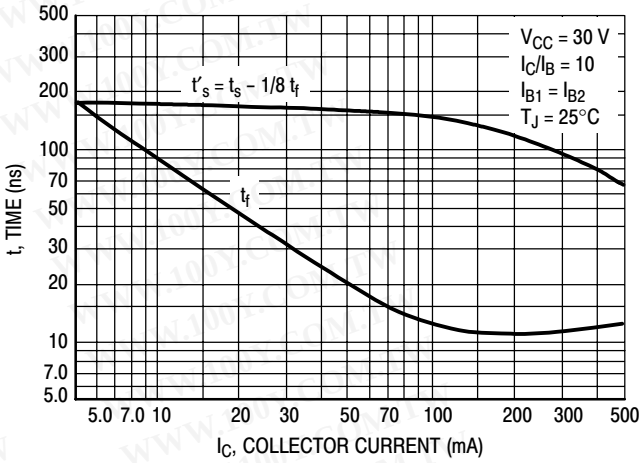


Figure 6. Turn−Off Time

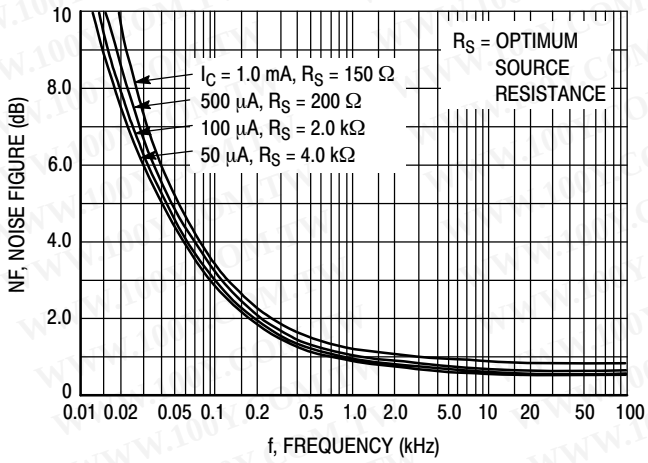


Figure 7. Frequency Effects

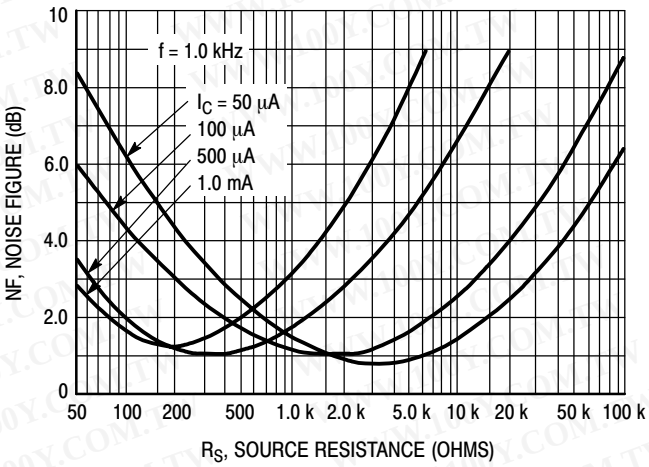


Figure 8. Source Resistance Effects

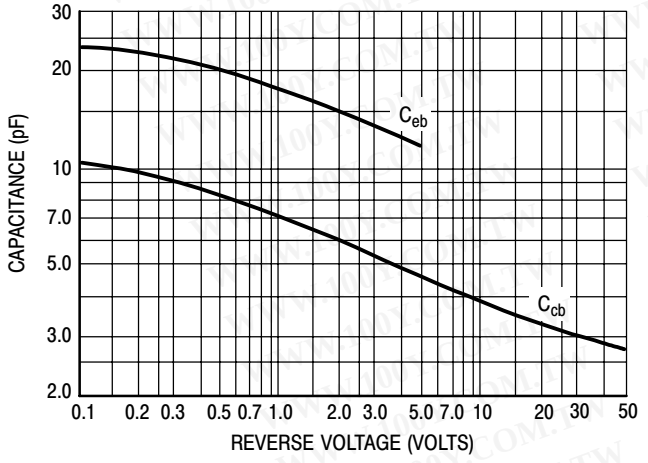


Figure 9. Capacitances

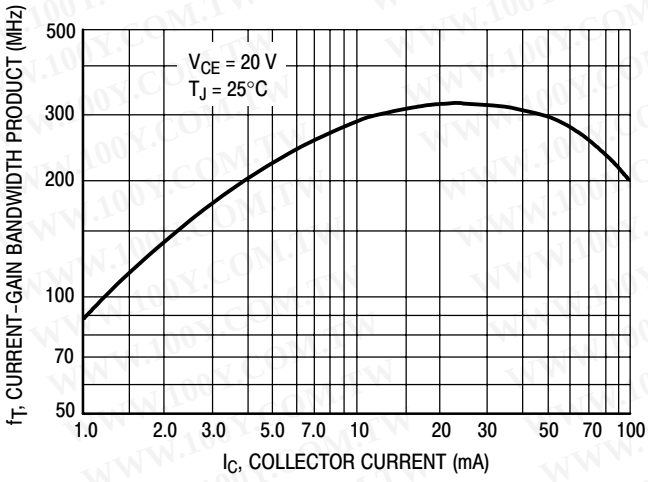


Figure 10. Current−Gain Bandwidth Product

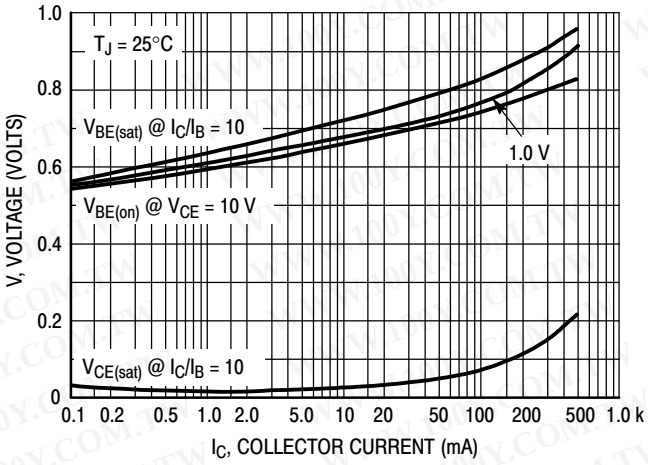


Figure 11. “On” Voltages

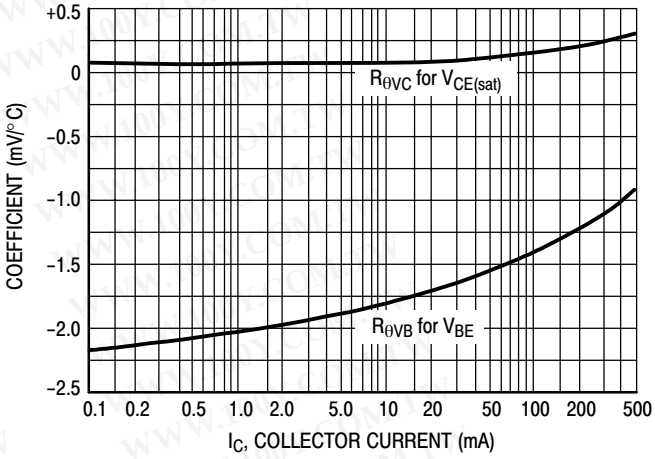
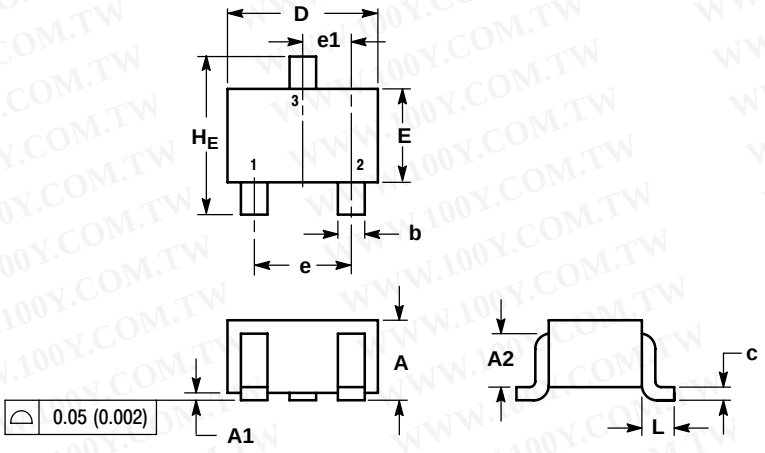


Figure 12. Temperature Coefficients

MMBT2222AWT1

PACKAGE DIMENSIONS

SC−70 (SOT−323)
CASE 419−04
ISSUE M

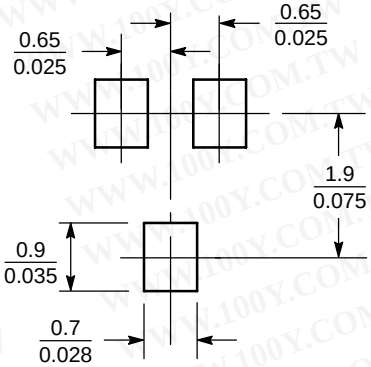


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.90	1.00	0.032	0.035	0.040
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2		0.7 REF			0.028 REF	
b	0.30	0.35	0.40	0.012	0.014	0.016
c	0.10	0.18	0.25	0.004	0.007	0.010
D	1.80	2.10	2.20	0.071	0.083	0.087
E	1.15	1.24	1.35	0.045	0.049	0.053
e	1.20	1.30	1.40	0.047	0.051	0.055
e1		0.65 BSC			0.026 BSC	
L		0.425 REF			0.017 REF	
H_E	2.00	2.10	2.40	0.079	0.083	0.095

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

SOLDERING FOOTPRINT*



SCALE 10:1 (mm / inches)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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