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.

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.
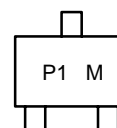
ON Semiconductor®

http://onsemi.com

COLLECTOR
3

1
BASE

2
EMITTER
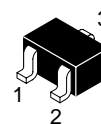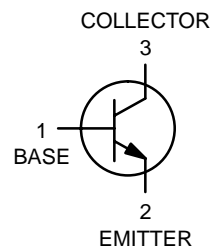
SC–70
CASE 419
STYLE 3

MARKING DIAGRAM

P1 M

P1 = Specific Device Code
M = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
MMBT2222AWT1	SC–70	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.

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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	k ohms
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

		Symbol	Min	Max	Unit
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%.

MMBT2222AWT1

SWITCHING TIME EQUIVALENT TEST CIRCUITS

+16 V

+30 V

1.0 to 100 µs,
DUTY CYCLE ≈ 2.0%

0

−2 V

200

1 kΩ

C_S* < 10 pF

< 2 ns
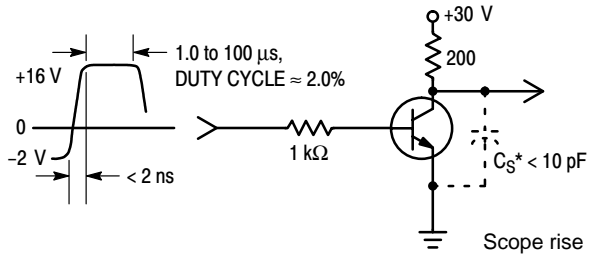
Scope rise time < 4 ns

Figure 1. Turn−On Time

+16 V

+30 V

1.0 to 100 µs,
DUTY CYCLE ≈ 2.0%

0

−14 V

200

1 k

1N914

C_S* < 10 pF

< 20 ns

−4 V

*Total shunt capacitance of test jig, connectors, and oscilloscope.
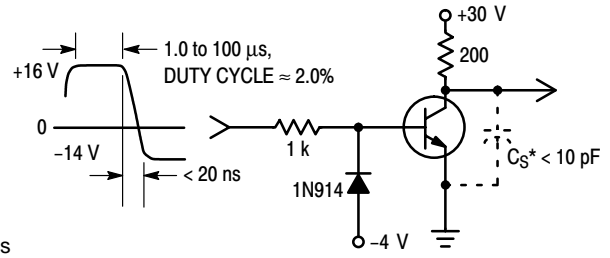
Figure 2. Turn−Off Time

T_J = 125°C

h_{FE}, DC CURRENT GAIN

25°C

−55°C

V_{CE} = 1.0 V
V_{CE} = 10 V

I_C, COLLECTOR CURRENT (mA)

Figure 3. DC Current Gain

V_{CE}, COLLECTOR−EMITTER VOLTAGE (VOLTS)

T_J = 25°C

I_C = 1.0 mA

10 mA

150 mA

500 mA

I_B, BASE CURRENT (mA)
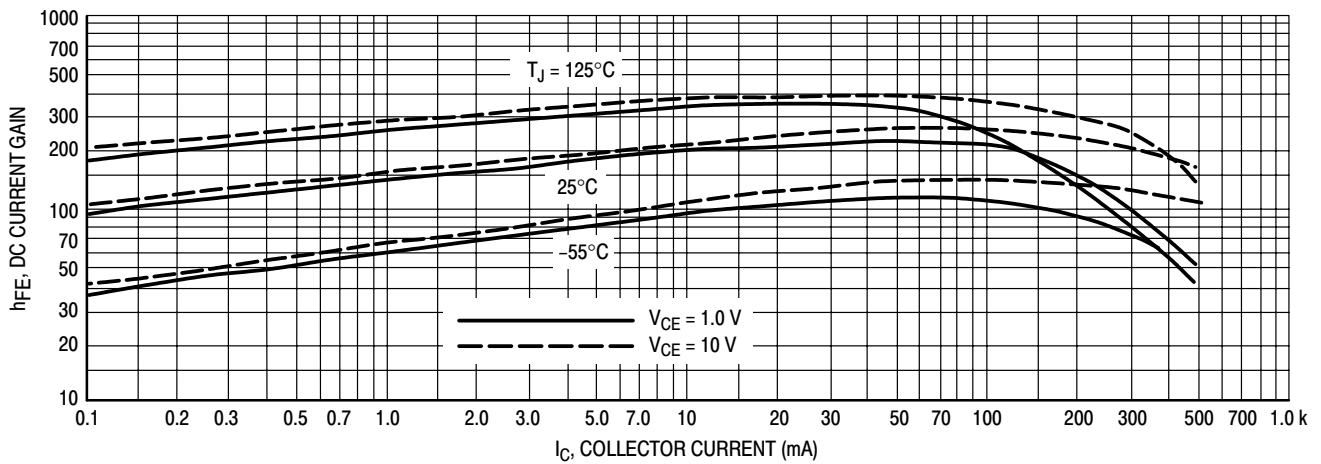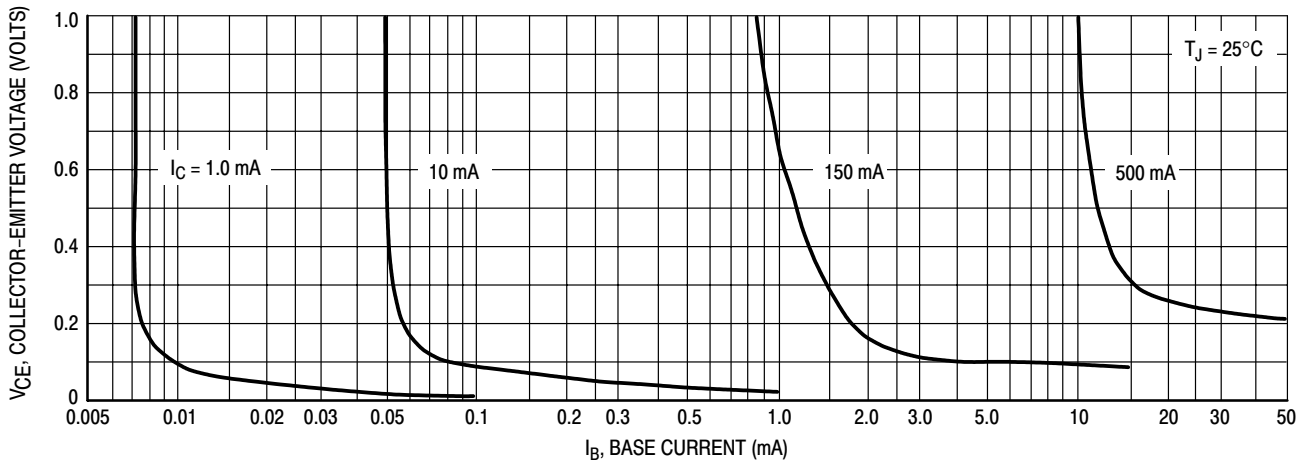
Figure 4. Collector Saturation Region
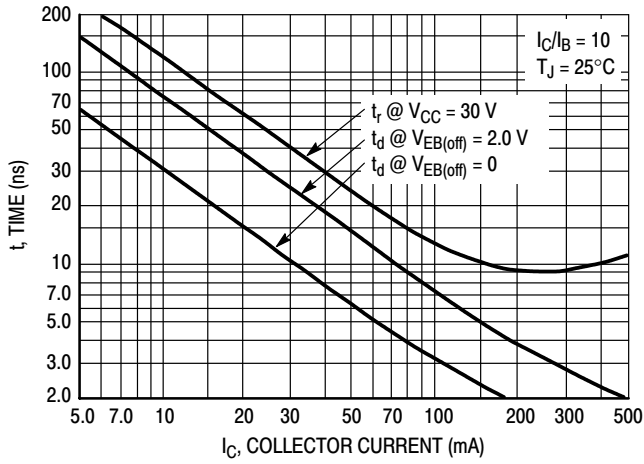
Figure 5. Turn−On Time
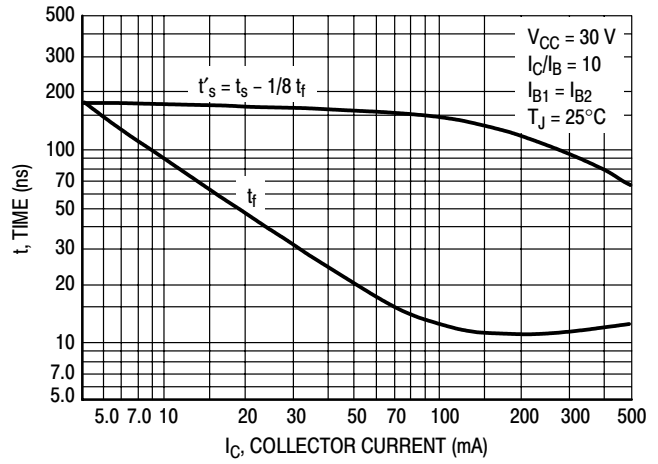
Figure 6. Turn−Off Time
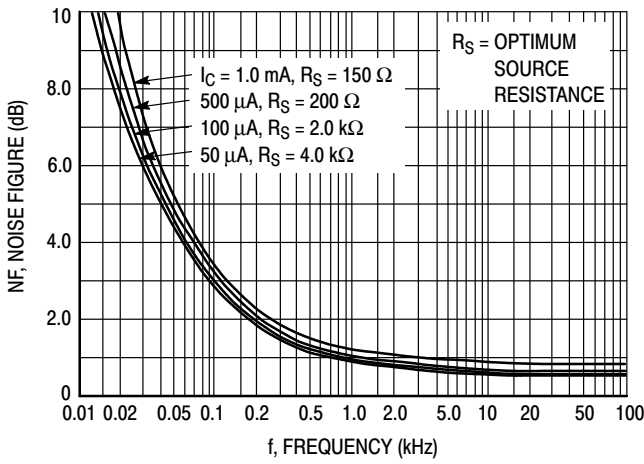
Figure 7. Frequency Effects
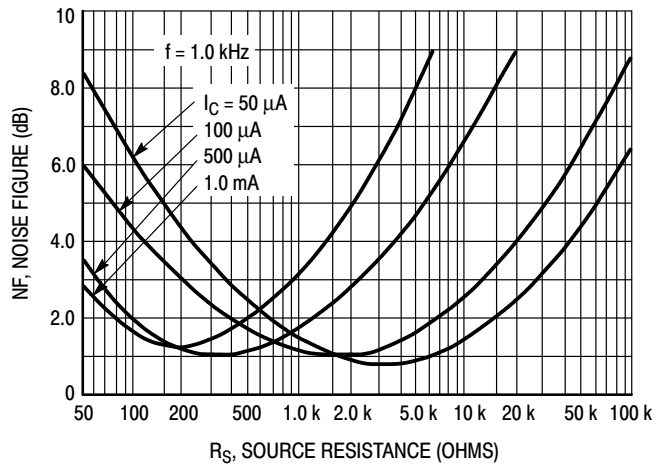
Figure 8. Source Resistance Effects
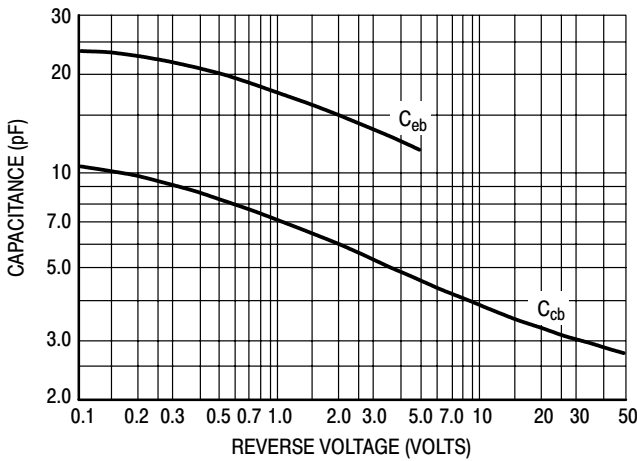
Figure 9. Capacitances
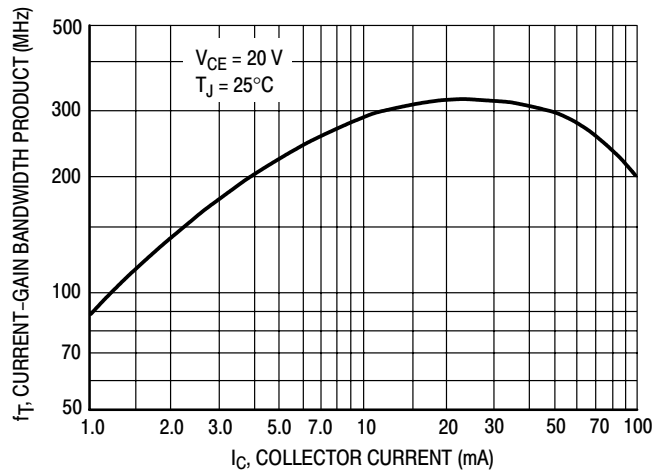
Figure 10. Current−Gain Bandwidth Product

MMBT2222AWT1
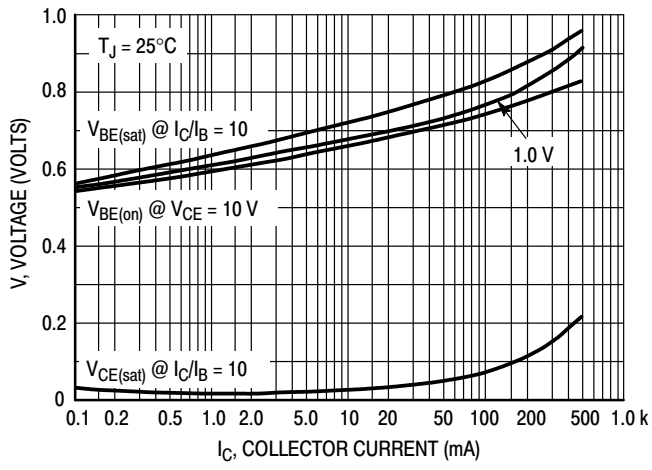
Figure 11. "On" Voltages
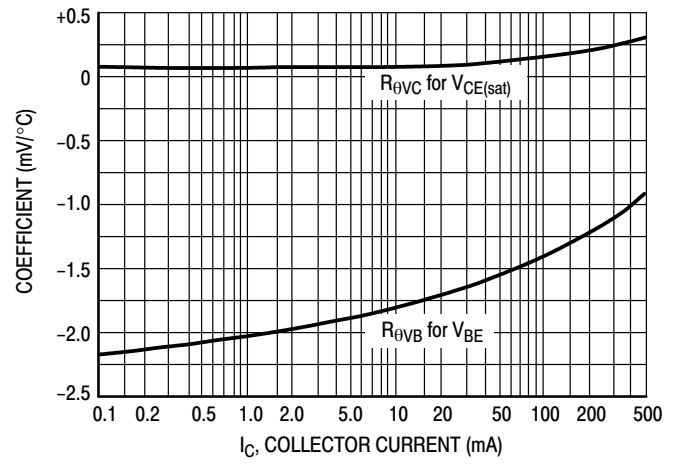
Figure 12. Temperature Coefficients

MMBT2222AWT1

PACKAGE DIMENSIONS

SC–70/SOT–323
CASE 419–04
ISSUE L
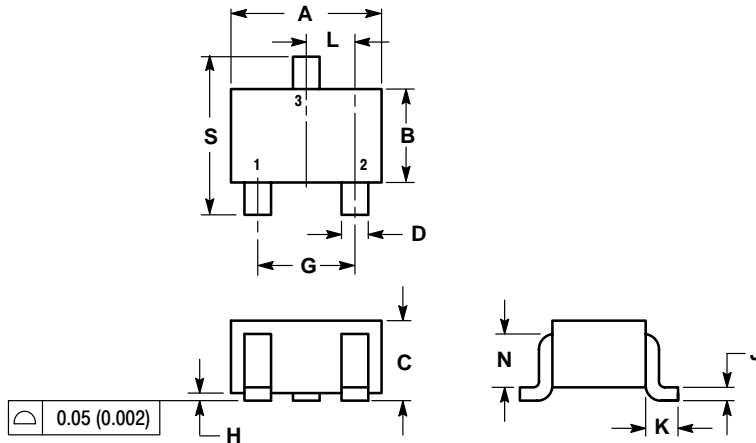
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.032	0.040	0.80	1.00
D	0.012	0.016	0.30	0.40
G	0.047	0.055	1.20	1.40
H	0.000	0.004	0.00	0.10
J	0.004	0.010	0.10	0.25
K	0.017 REF		0.425 REF	
L	0.026 BSC		0.650 BSC	
N	0.028 REF		0.700 REF	
S	0.079	0.095	2.00	2.40

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

SOLDERING FOOTPRINT

SCALE 10:1 $\left(\dfrac{mm}{inches}\right)$

PUBLICATION ORDERING INFORMATION