



MMBT2222LTG, MMBT2222ALTG

General Purpose Transistors

Features

- Pb-Free Package May be Available. The G-Suffix Denotes a
- Pb-Free Lead Finish

Ordering Information

Device	Package	Shipping
MMBT2222LTG	SOT-23	3000/Tape & Reel
MMBT2222ALTG	SOT-23	3000/Tape & Reel

Maximum Ratings

Rating	Symbol	2222	2222A	Unit
Collector-Emitter Voltage	V_{CEO}	30	40	Vdc
Collector-Base Voltage	V_{CBO}	60	75	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	6.0	Vdc
Collector Current — Continuous	I_C	600	600	mAdc

Thermal Characteristics

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board ⁽¹⁾ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Total Device Dissipation Alumina Substrate, ⁽²⁾ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

Device Marking

MMBT2222LTG = M1B; MMBT2222ALTG = 1P

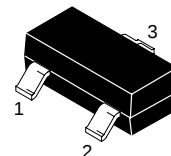
Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 10\text{ mAdc}$, $I_B = 0$)	MMBT2222LTG MMBT2222ALTG	$V_{(BR)CEO}$	30 40	— —	Vdc
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{Adc}$, $I_E = 0$)	MMBT2222LTG MMBT2222ALTG	$V_{(BR)CBO}$	60 75	— —	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{Adc}$, $I_C = 0$)	MMBT2222LTG MMBT2222ALTG	$V_{(BR)EBO}$	5.0 6.0	— —	Vdc
Collector Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $V_{EB(off)} = 3.0\text{ Vdc}$)	MMBT2222ALTG	I_{CEX}	—	10	nAdc
Collector Cutoff Current ($V_{CB} = 50\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 60\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 50\text{ Vdc}$, $I_E = 0$, $T_A = 125^\circ\text{C}$) ($V_{CB} = 60\text{ Vdc}$, $I_E = 0$, $T_A = 125^\circ\text{C}$)	MMBT2222LTG MMBT2222ALTG MMBT2222LTG MMBT2222ALTG	I_{CBO}	— — — —	0.01 0.01 10 10	μAdc
Emitter Cutoff Current ($V_{EB} = 3.0\text{ Vdc}$, $I_C = 0$)	MMBT2222ALTG	I_{EBO}	—	100	nAdc
Base Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $V_{EB(off)} = 3.0\text{ Vdc}$)	MMBT2222ALTG	I_{BL}	—	20	nAdc

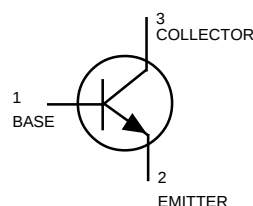
1. FR-5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

Package outline



SOT-23



Electrical Characteristics (T_A = 25°C unless otherwise noted.) (Continued)

Characteristic		Symbol	Min	Max	Unit
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) only (I _C = 150 mAdc, V _{CE} = 10 Vdc) (3) (I _C = 150 mAdc, V _{CE} = 1.0 Vdc) (3) (I _C = 500 mAdc, V _{CE} = 10 Vdc) (3)	MMBT2222ALTG MMBT2222LTG MMBT2222ALTG	h _{FE}	35 50 75 35 100 50 30 40	— — — — 300 — — —	—
Collector–Emitter Saturation Voltage (3) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	MMBT2222LTG MMBT2222ALTG MMBT2222LTG MMBT2222ALTG	V _{CE(sat)}	— — — —	0.4 0.3 1.6 1.0	Vdc
Base–Emitter Saturation Voltage (3) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 500 mAdc, I _B = 50 mAdc)	MMBT2222LTG MMBT2222ALTG MMBT2222LTG MMBT2222ALTG	V _{BE(sat)}	— 0.6 — —	1.3 1.2 2.6 2.0	Vdc
SMALL–SIGNAL CHARACTERISTICS					
Current–Gain — Bandwidth Product (4) (I _C = 20 mAdc, V _{CE} = 20 Vdc, f = 100 MHz)	MMBT2222LTG MMBT2222ALTG	f _T	250 300	— —	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)	MMBT2222LTG MMBT2222ALTG	C _{ibo}	— —	30 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)	MMBT2222ALTG MMBT2222ALTG	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)	MMBT2222ALTG MMBT2222ALTG	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)	MMBT2222ALTG MMBT2222ALTG	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)	MMBT2222ALTG MMBT2222ALTG	h _{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant (I _E = 20 mAdc, V _{CB} = 20 Vdc, f = 31.8 MHz)	MMBT2222ALTG	rb, C _c	—	150	ps
Noise Figure (I _C = 100 μAdc, V _{CE} = 10 Vdc, R _S = 1.0 kΩ, f = 1.0 kHz)	MMBT2222ALTG	NF	—	4.0	dB
SWITCHING CHARACTERISTICS (MMBT2222A only)					
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.

Switching Time Equivalent Test Circuits

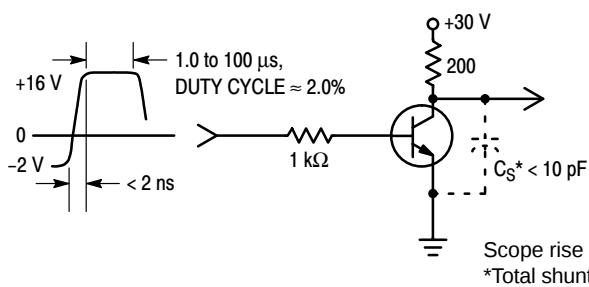


Figure 1. Turn-On Time

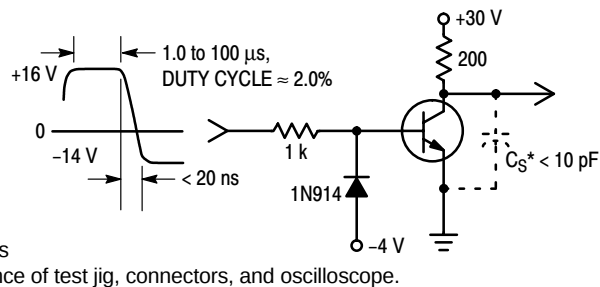


Figure 2. Turn-Off Time

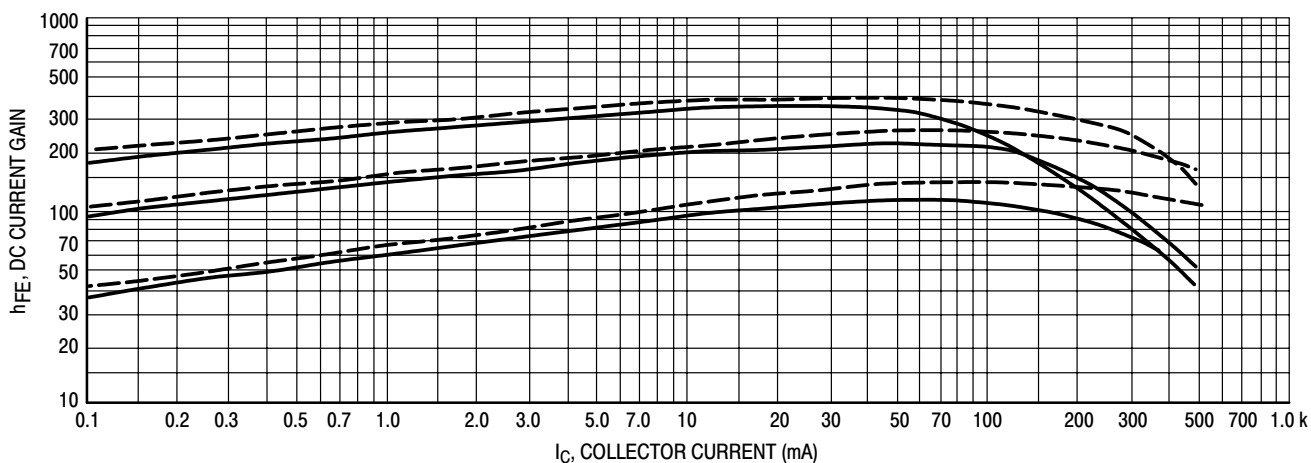


Figure 3. DC Current Gain

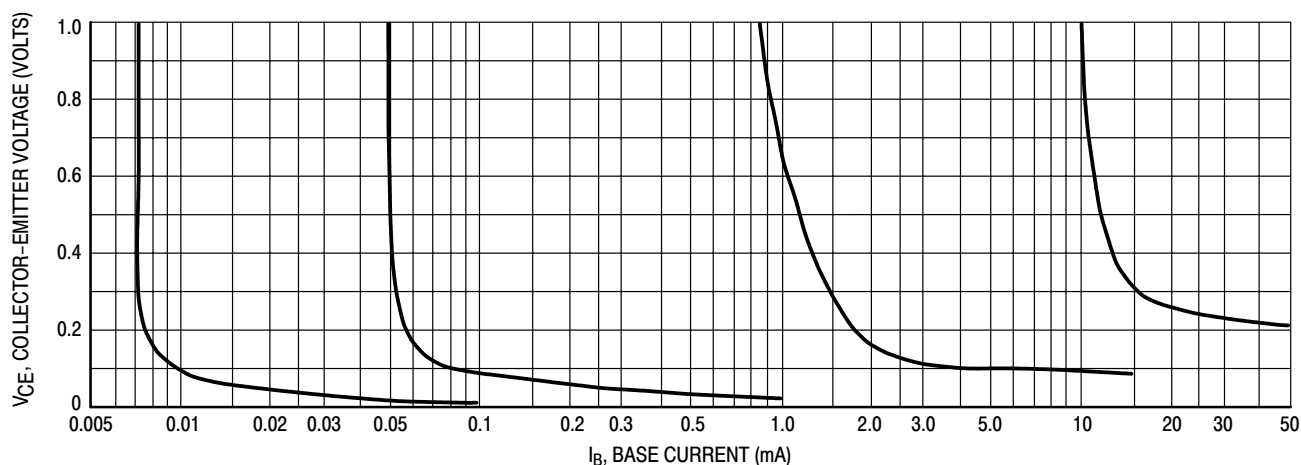


Figure 4. Collector Saturation Region

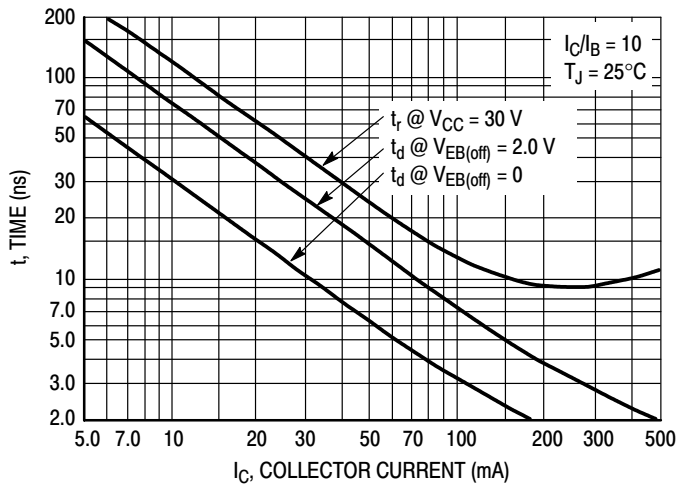


Figure 5. Turn-On Time

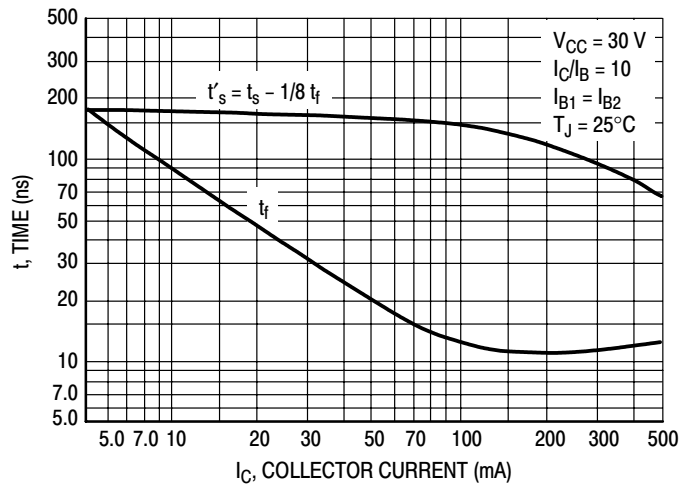


Figure 6. Turn-Off Time

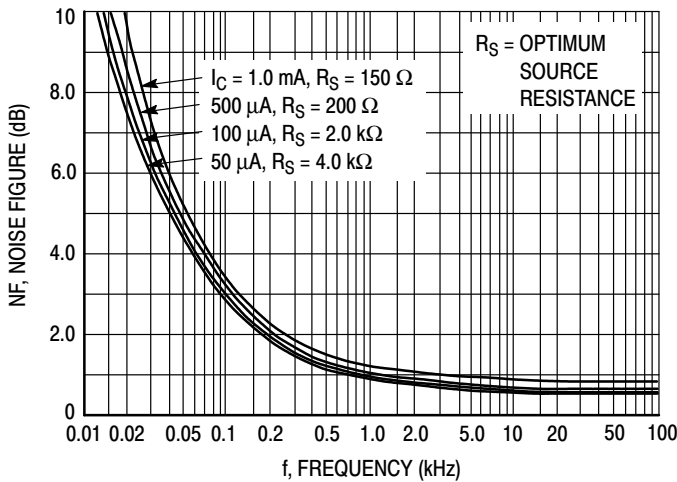


Figure 7. Frequency Effects

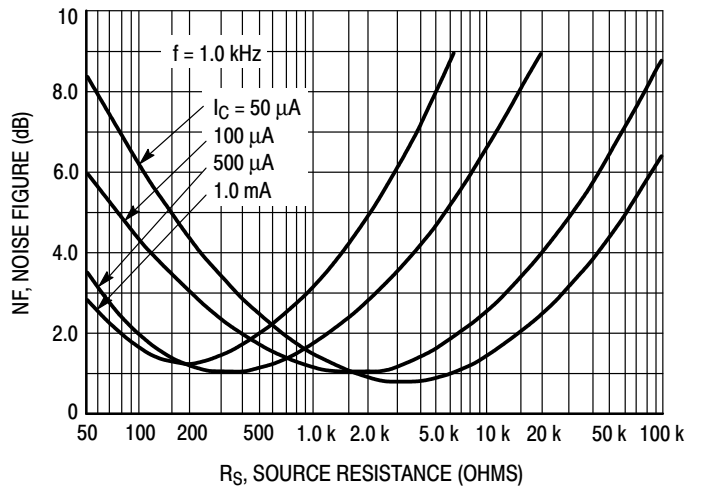


Figure 8. Source Resistance Effects

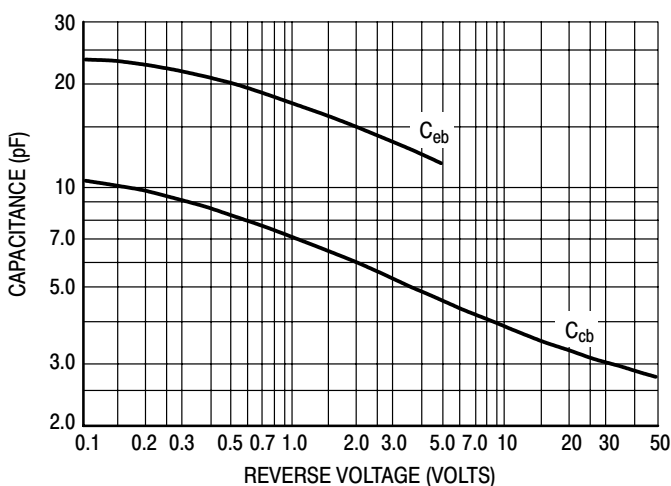


Figure 9. Capacitances

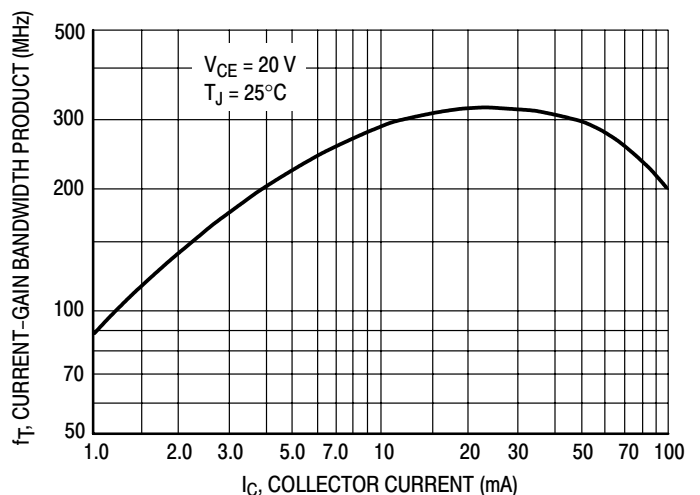


Figure 10. Current-Gain Bandwidth Product

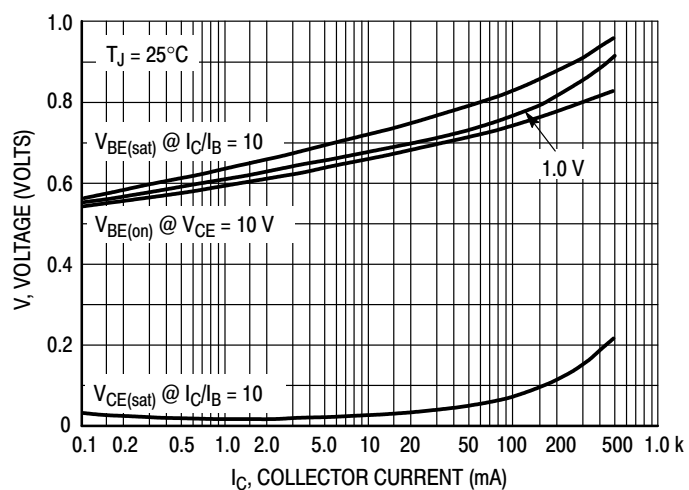


Figure 11. "On" Voltages

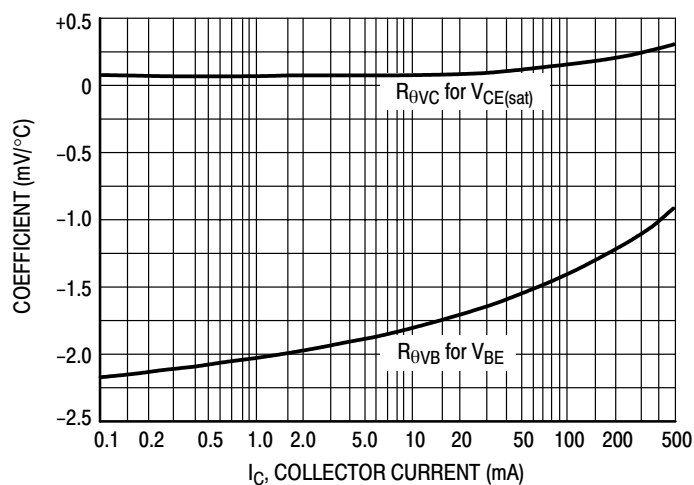
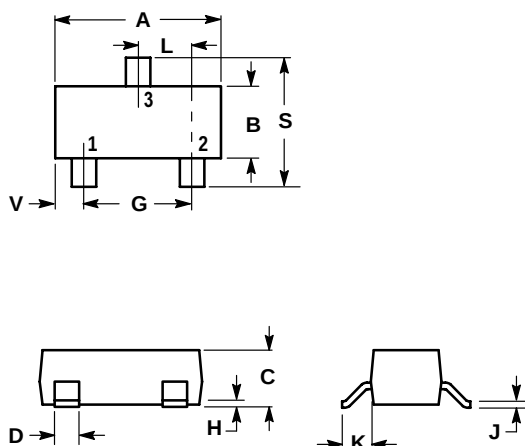


Figure 12. Temperature Coefficients

Package Dimensions

SOT-23



NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

PIN 1. BASE

2. EMITTER

3. COLLECTOR

