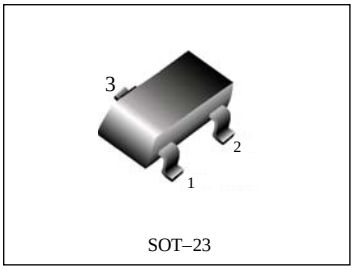
General Purpose Transistor

NPN Silicon

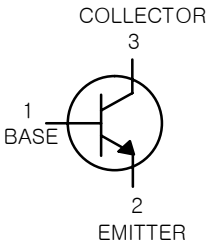


SOT−23

• We declare that the material of product compliance with RoHS requirements.

ORDERING INFORMATION

Device	Marking	Shipping
MMBT2222A	1P	3000 / Tape & Reel



MAXIMUM RATINGS (T_A = 25℃)

Rating	Symbol	Max	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 (Note 1) T_A = 25℃	P_D	350	mW
Thermal Resistance, (Note 1) Junction−to−Ambient	$R_{\theta JA}$	357	℃/W
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	℃

ELECTRICAL CHARACTERISTICS (T_A = 25℃ 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 2)

DC Current Gain	H_{FE}			–
(I_C = 0.1 mAdc, V_{CE} = 10 Vdc)		35	–	
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc)		50	–	
(I_C = 10 mAdc, V_{CE} = 10 Vdc)		75	–	
(I_C = 150 mAdc, V_{CE} = 10 Vdc)		100	300	
(I_C = 500 mAdc, V_{CE} = 10 Vdc)		40	–	
Collector−Emitter Saturation Voltage	$V_{CE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)		–	0.3	
(I_C = 500 mAdc, I_B = 50 mAdc)		–	1.0	
Base−Emitter Saturation Voltage	$V_{BE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)		0.6	1.2	
(I_C = 500 mAdc, I_B = 50 mAdc)		–	2.0	

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}	–	25	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 k ohms, f = 1.0 kHz)	NF	–	4.0	dB

SWITCHING CHARACTERISTICS

Delay Time	(V_{CC} = 30 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. Device mounted on FR-4 PCB 16*16*0.6mm or on 99.5% alumina 10*8*0.6mm
2. Pulse Test: Pulse Width ≤300 μs, Duty Cycle ≤2.0%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

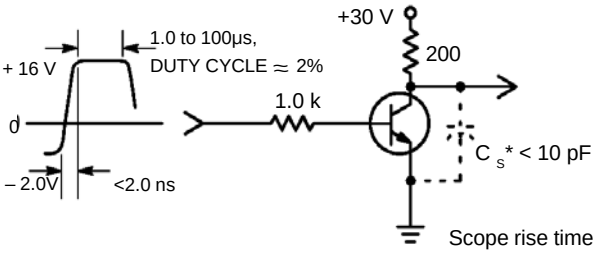


Figure 1. Turn–On Time

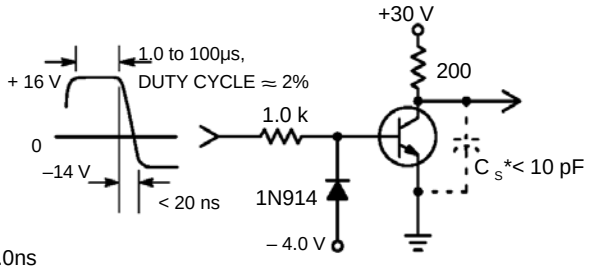


Figure 2. Turn–Off Time

Scope rise time < 4.0ns

*Total shunt capacitance of test jig, connectors, and oscilloscope.

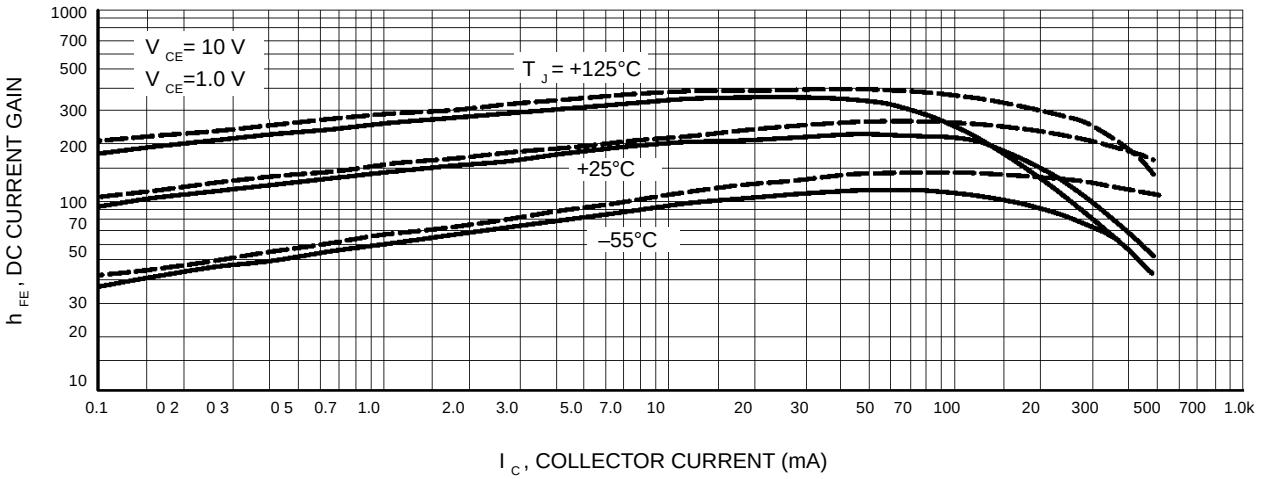


Figure 3. DC Current Gain

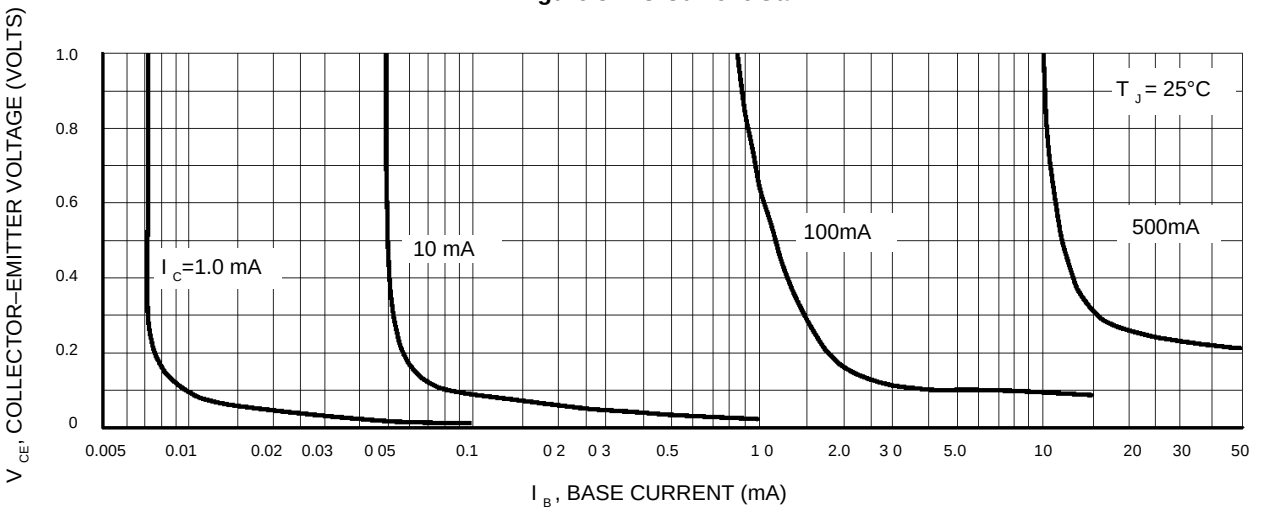


Figure 4. Collector Saturation Region

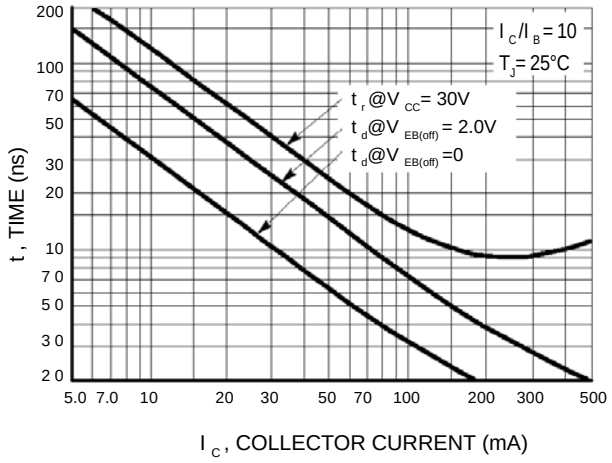


Figure 5. Turn–On Time

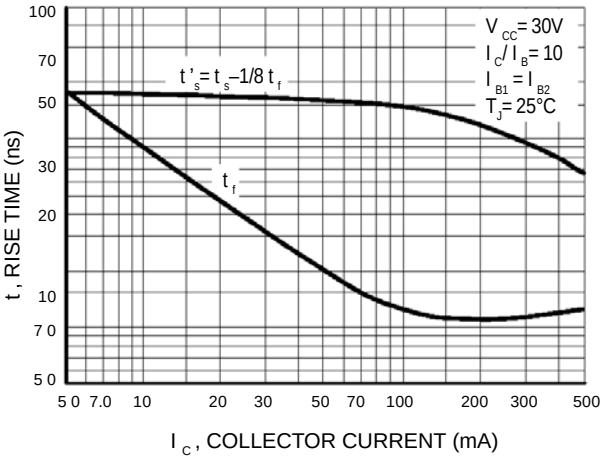


Figure 6. Turn - Off Time

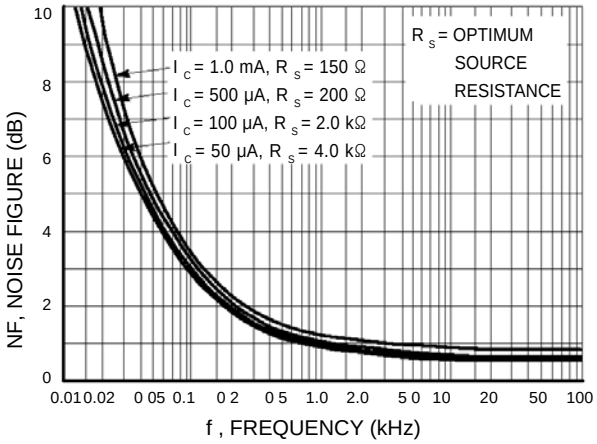


Figure 7. Frequency Effects

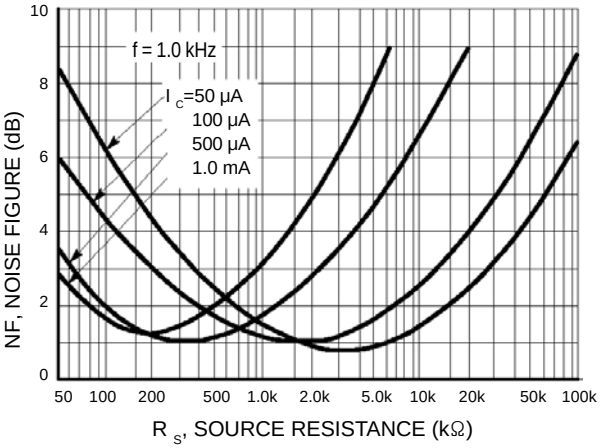


Figure 8. Source Resistance Effects

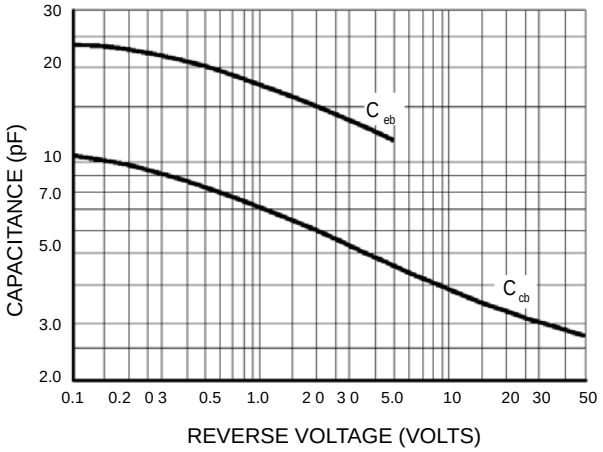


Figure 9. Capacitance

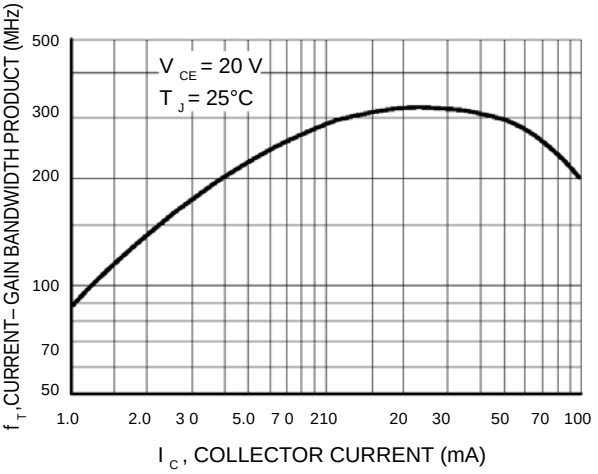
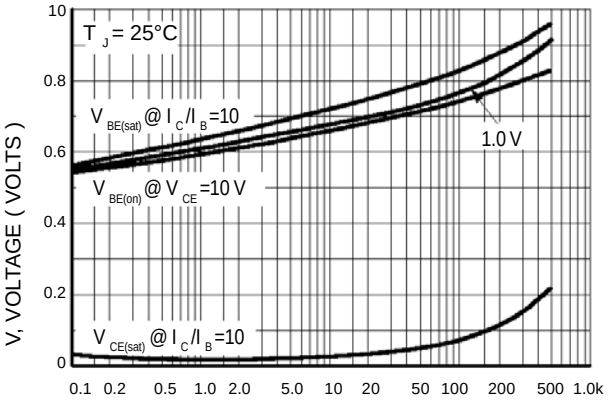
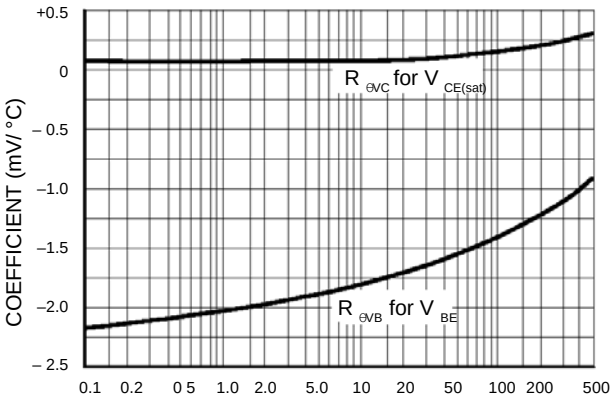


Figure 10. Current– Gain Bandwidth Product



I C , COLLECTOR CURRENT (mA)

Figure 11. “On” Voltages



I C , COLLECTOR CURRENT (mA)

Figure 12. Temperature Coefficients

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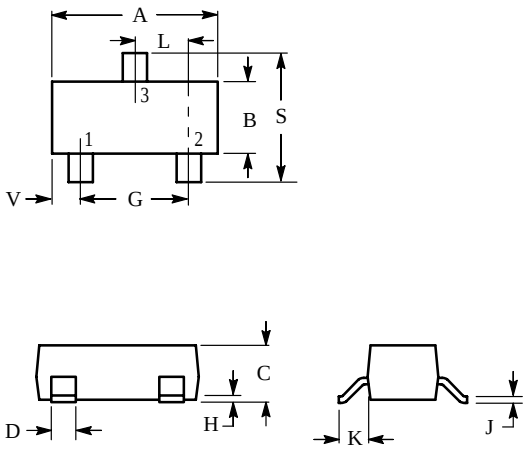

NOTES:

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