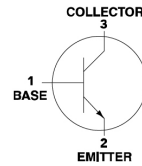


## NPN General Purpose Transistors



### 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		mAdc

### THERMAL CHARACTERISTICS

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

### ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Min	Max	Unit
-----------------	--------	-----	-----	------

### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C=10\text{ mAdc}, I_E=0$ )	MMBT2222 MMBT2222A	$V_{(BR)CEO}$	30 40	-	Vdc
Collector-Base Breakdown Voltage ( $I_C=10\ \mu\text{Adc}, I_E=0$ )	MMBT2222 MMBT2222A	$V_{(BR)CBO}$	60 75	-	Vdc
Emitter-Base Breakdown Voltage ( $I_E=10\ \mu\text{Adc}, I_C=0$ )	MMBT2222 MMBT2222A	$V_{(BR)EBO}$	5.0 6.0	-	Vdc
Collector Cutoff Current ( $V_{CE}=60\text{ Vdc}, V_{EB}(\text{off})=3.0\text{ Vdc}$ )	MMBT2222A	$I_{CEX}$	-	10	nAdc
Collector Cutoff Current ( $V_{CB}=50\text{ Vdc}, I_E=0$ ) ( $V_{CB}=60\text{ Vdc}, I_E=0$ ) ( $V_{CB}=50\text{ Vdc}, I_E=0, T_A=125^\circ\text{C}$ ) ( $V_{CB}=60\text{ Vdc}, I_E=0, T_A=125^\circ\text{C}$ )	MMBT2222 MMBT2222A MMBT2222 MMBT2222A	$I_{CBO}$	- - - -	0.01 0.01 10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB}=3.0\text{ Vdc}, I_C=0$ )	MMBT2222A	$I_{EBO}$	-	100	nAdc
Base Cutoff Current ( $V_{CE}=60\text{ Vdc}, V_{EB}(\text{off})=3.0\text{ Vdc}$ )	MMBT2222A	$I_{BL}$	-	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

## MMBT2222 MMBT2222A

### ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=25 C unless otherwise noted) (Continued)

Characteristics	Symbol	Min	Max	Unit
-----------------	--------	-----	-----	------

#### ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> =0.1 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> ) (I <sub>C</sub> =1.0 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> ) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> ) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> , T <sub>A</sub> =-55 C) (I <sub>C</sub> =150 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> ) (3) (I <sub>C</sub> =150 mA <sub>dc</sub> , V <sub>CE</sub> =1.0V <sub>dc</sub> ) (3) (I <sub>C</sub> =500 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> ) (3)	MMBT2222A ONLY      MMBT2222 MMBT2222A	h <sub>FE</sub>	35 50 75 35 100 50 30 40	- - - - 300 - - -	-
Collector-Emitter Saturation Voltage (3) (I <sub>C</sub> =150 mA <sub>dc</sub> , I <sub>B</sub> =15mA <sub>dc</sub> )  (I <sub>C</sub> =500 mA <sub>dc</sub> , I <sub>B</sub> =50mA <sub>dc</sub> )	MMBT2222 MMBT2222A  MMBT2222 MMBT2222A	V <sub>CE(sat)</sub>	- - - -	0.4 0.3 1.6 1.0	V <sub>dc</sub>
Base-Emitter Saturation Voltage (3) (I <sub>C</sub> =150 mA <sub>dc</sub> , I <sub>B</sub> =15mA <sub>dc</sub> )  (I <sub>C</sub> =500 mA <sub>dc</sub> , I <sub>B</sub> =50mA <sub>dc</sub> )	MMBT2222 MMBT2222A  MMBT2222 MMBT2222A	V <sub>BE(sat)</sub>	- 0.6 - -	1.3 1.2 2.6 2.0	V <sub>dc</sub>

#### SMALL-SIGNAL CHARACTERISTICS

Current-Gain-Bandwidth Product (4) (I <sub>C</sub> =20 mA <sub>dc</sub> , V <sub>CE</sub> =20 V <sub>dc</sub> , f=100MHz)	MMBT2222 MMBT2222A	f <sub>T</sub>	250 300	- -	MHz
Output Capacitance (V <sub>CB</sub> =10 V <sub>dc</sub> , I <sub>E</sub> =0, f=1.0MHz)	MMBT2222 MMBT2222A	C <sub>obo</sub>	-	8.0	pF
Input Capacitance (V <sub>EB</sub> =0.5 V <sub>dc</sub> , I <sub>C</sub> =0, f=1.0MHz)	MMBT2222 MMBT2222A	C <sub>ibo</sub>	- -	30 25	pF
Input Impedance (I <sub>C</sub> =1.0 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> , f=1.0 kHz) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> , f=1.0 kHz)	MMBT2222A MMBT2222A	h <sub>ie</sub>	2.0 0.25	8.0 1.25	k
Voltage Feedback Ratio (I <sub>C</sub> =1.0 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> , f=1.0 kHz) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10 V <sub>dc</sub> , f=1.0 kHz)	MMBT2222A MMBT2222A	h <sub>re</sub>	- -	8.0 4.0	x 10 <sup>-4</sup>
Small-Signal Current Gain (I <sub>C</sub> =1.0 mA <sub>dc</sub> , V <sub>CE</sub> =10V <sub>dc</sub> , f=1.0 kHz) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10V <sub>dc</sub> , f=1.0 kHz)	MMBT2222A MMBT2222A	h <sub>fe</sub>	50 75	300 375	-
Output Admittance (I <sub>C</sub> =1.0 mA <sub>dc</sub> , V <sub>CE</sub> =10V <sub>dc</sub> , f=-1.0kHz) (I <sub>C</sub> =10 mA <sub>dc</sub> , V <sub>CE</sub> =10V <sub>dc</sub> , f=-1.0kHz)	MMBT2222A MMBT2222A	h <sub>oe</sub>	5.0 25	35 200	μmhos
Collector Base Time Constant (I <sub>E</sub> =20 mA <sub>dc</sub> , V <sub>CB</sub> =20 V <sub>dc</sub> , f=31.8 MHz)	MMBT2222A	r <sub>b</sub> , C <sub>c</sub>	-	150	ps
Noise Figure (I <sub>C</sub> =100 μA <sub>dc</sub> , V <sub>CE</sub> =10V <sub>dc</sub> , R <sub>S</sub> =1.0k, f=1.0kHz)	MMBT2222A	NF	-	4.0	dB

## MMBT2222 MMBT2222A

### ELECTRICAL CHARACTERISTICS ( $T_A=25\text{ C}$ unless otherwise noted) (Continued)

Characteristics	Symbol	Min	Max	Unit
-----------------	--------	-----	-----	------

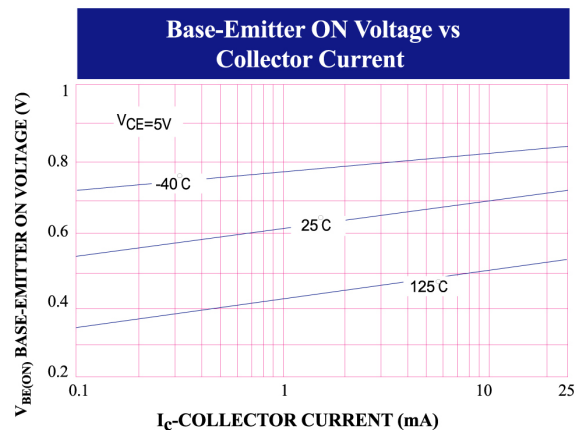
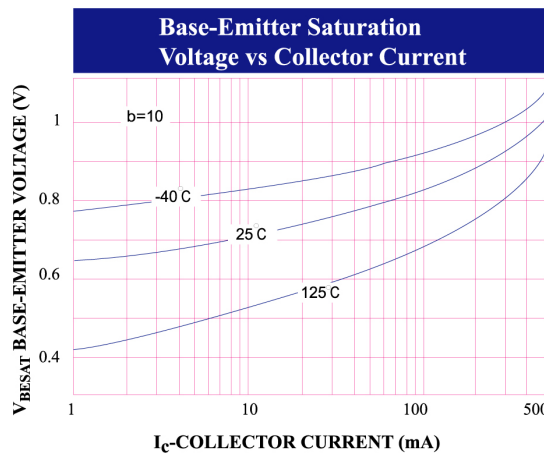
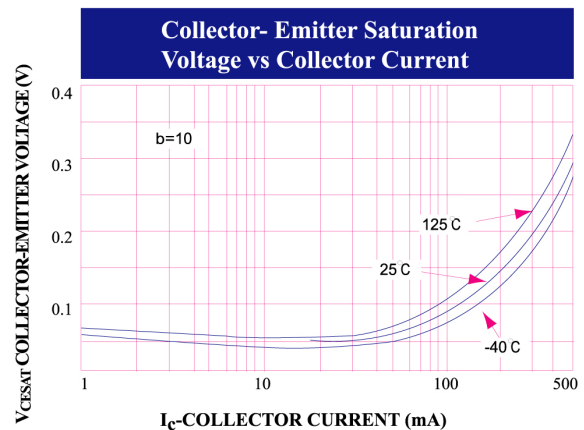
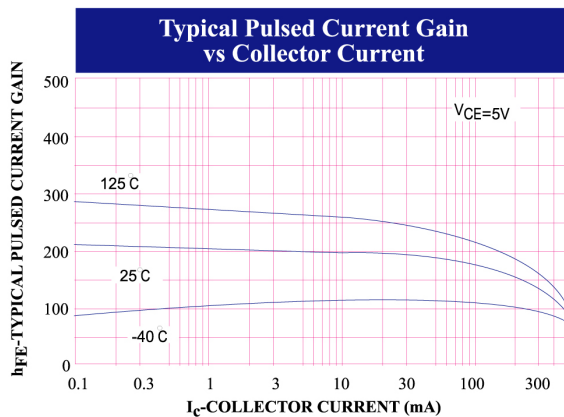
### SWITCHING CHARACTERISTICS (MMBT2222A only)

Delay Time	$(V_{CC}=30\text{ Vdc}, V_{BE}(\text{off})=-0.5\text{ Vdc}, I_C=150\text{ mA}, I_{B1}=15\text{ mA})$	$t_d$	-	10	ns
Rise Time		$t_r$	-	25	
Storage Time	$(V_{CC}=30\text{ Vdc}, I_C=150\text{ mA}, I_{B1}=I_{B2}=15\text{ mA})$	$t_s$	-	225	ns
Fall Time		$t_f$	-	60	

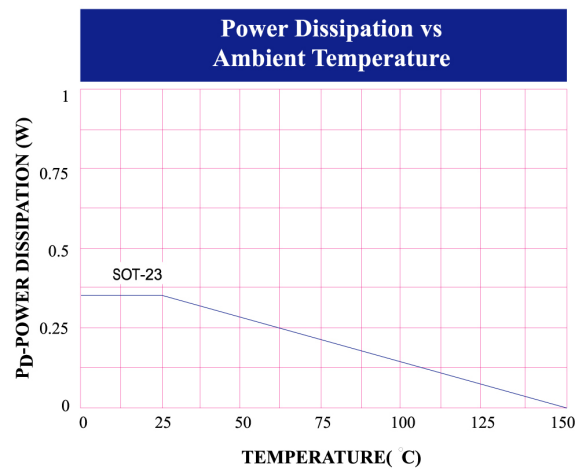
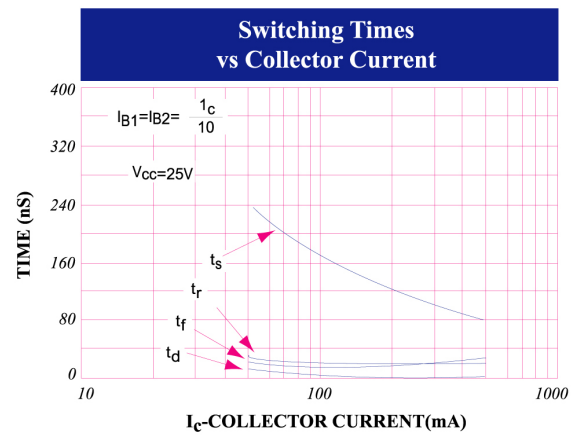
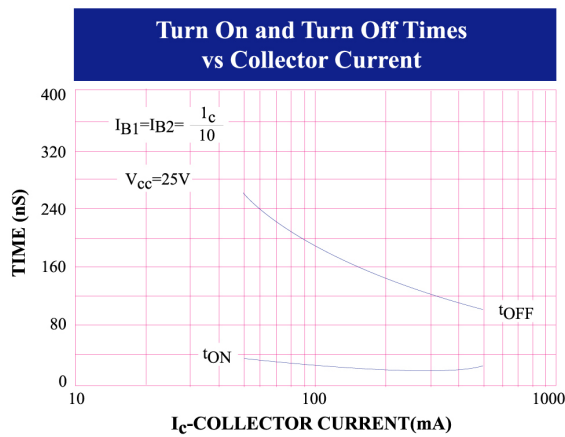
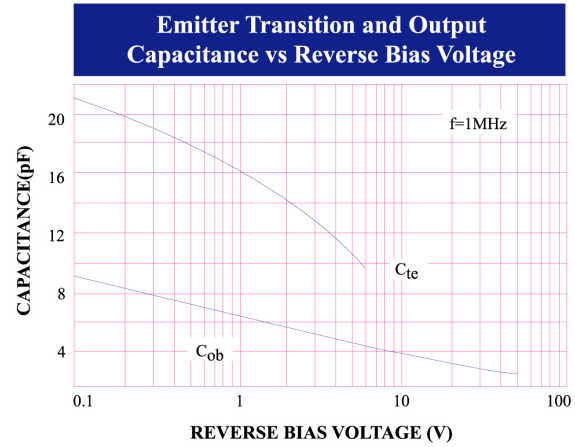
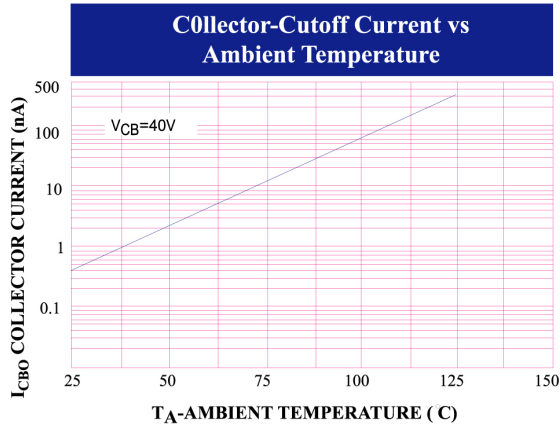
3. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

4.  $t_r$  is defined as the frequency at which  $I_{hfe}$  extrapolates to unity.

## Typical Characteristics

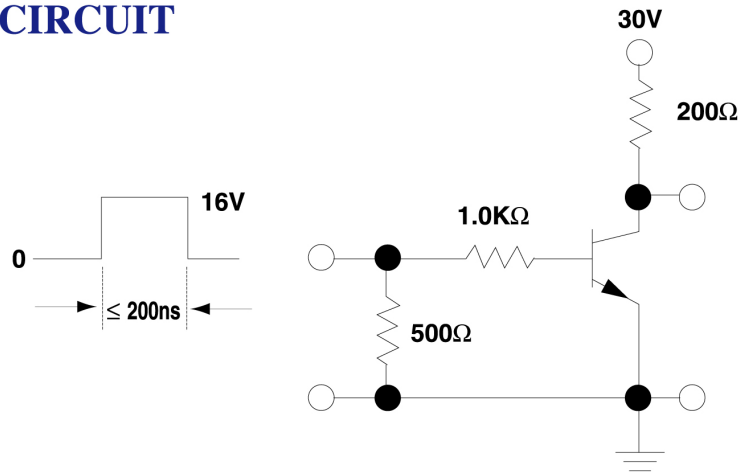


## MMBT2222 MMBT2222A

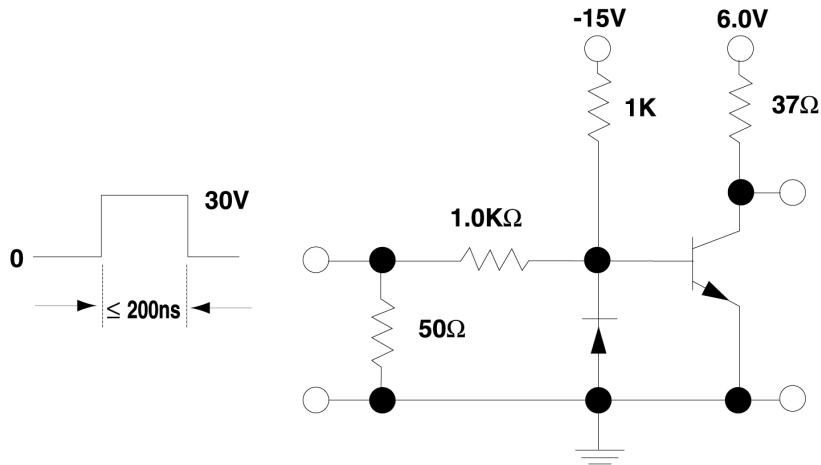


**MMBT2222  
MMBT2222A**

**TEST CIRCUIT**



**FIGURT 1: Saturated Turn-On Switching Time**

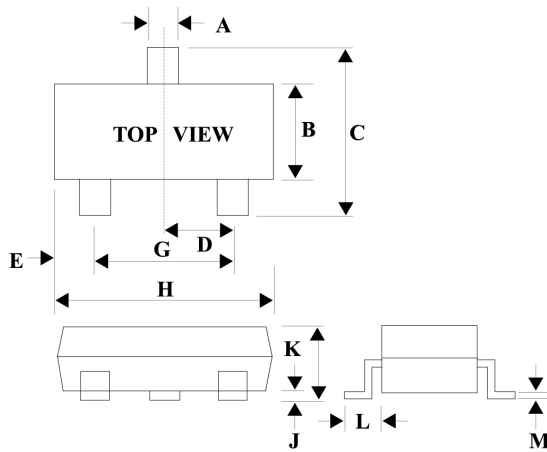


**FIGURT 2: Saturated Turn-Off Switching Time**

## MMBT2222 MMBT2222A

### SOT-23 Outline Dimensions

Unit:mm



Dim	Min	Max
A	0.35	0.51
B	1.19	1.40
C	2.10	3.00
D	0.85	1.05
E	0.46	1.00
G	1.70	2.10
H	2.70	3.10
J	0.01	0.13
K	0.89	1.10
L	0.30	0.61
M	0.076	0.25

