

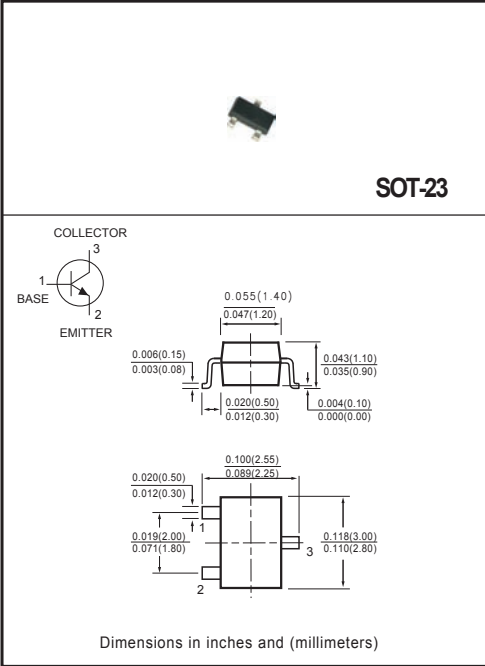
**SOT-23 BIPOLAR TRANSISTORS  
TRANSISTOR(NPN)**

**FEATURES**

- \* Epitaxial planar die construction
- \* Complementary PNP Type available(MMBT2907A)

**MECHANICAL DATA**

- \* Case: Molded plastic
- \* Epoxy: UL 94V-O rate flame retardant
- \* Lead: MIL-STD-202E method 208C guaranteed
- \* Mounting position: Any
- \* Weight: 0.008 gram



**MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS**

Ratings at 25 °C ambient temperature unless otherwise specified.  
Single phase, half wave, 60 Hz, resistive or inductive load.  
For capacitive load, derate current by 20%.

**MAXIMUM RATINGS** ( @ TA = 25°C unless otherwise noted )

RATINGS	SYMBOL	VALUE	UNITS
Max. Steady State Power Dissipation <sup>(1)</sup> @TA=25°C Derate above 25°C	PD	300	mW
Max. Operating Temperature Range	TJ	150	°C
Storage Temperature Range	TSTG	-55 to +150	°C

**ELECTRICAL CHARACTERISTICS** ( @ TA = 25°C unless otherwise noted )

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNITS
Thermal Resistance Junction to Ambient	R θJA	-	-	417	°C/W

Notes: 1. Alumina=0.4\*0.3\*0.024in, 99.5% alumina.  
2. " Fully ROHS Compliant ", "100% Sn plating (Pb-free)".

**ELECTRICAL CHARACTERISTICS** (@TA=25°C unless otherwise noted)

Chatacteristic	Symbol	Min	Max	Unit
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**OFF CHARACTERISTICS**

Collector-Emitter Breakdown Voltage ( $I_C = 10\text{mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	40	-	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10\text{mA}$ , $I_E = 0$ )	$V_{(BR)CBO}$	75	-	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10\text{mA}$ , $I_C = 0$ )	$V_{(BR)EBO}$	6.0	-	Vdc
Collector Cutoff Current ( $V_{CE} = 60\text{Vdc}$ , $V_{EB(off)} = 3.0\text{Vdc}$ )	$I_{CEX}$	-	0.1	$\mu\text{A}$
Collector Cutoff Current ( $V_{CB} = 60\text{Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 60\text{Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ )	$I_{CBO}$	-	0.01 10	$\mu\text{A}$
Emitter Cutoff Current ( $V_{EB} = 3.0\text{Vdc}$ , $I_C = 0$ )	$I_{EBO}$	-	0.1	$\mu\text{A}$
Base Cutoff Current ( $V_{CE} = 60\text{Vdc}$ , $V_{EB(off)} = 3.0\text{Vdc}$ )	$I_{BL}$	-	20	nA

**ON CHARACTERISTICS**

DC Current Gain ( $I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $T_A = -55^\circ\text{C}$ ) ( $I_C = 500\text{mA}$ , $V_{CE} = 10\text{Vdc}$ ) (1)	hFE	35 40	- -	-
Collector-Emitter Saturation Voltage (1) ( $I_C = 150\text{mA}$ , $I_B = 15\text{mA}$ ) ( $I_C = 500\text{mA}$ , $I_B = 50\text{mA}$ )	$V_{CE(sat)}$	- -	0.3 1.0	Vdc
Base-Emitter Saturation Voltage (1) ( $I_C = 150\text{mA}$ , $I_B = 15\text{mA}$ ) ( $I_C = 500\text{mA}$ , $I_B = 50\text{mA}$ )	$V_{BE(sat)}$	0.6 -	1.2 2.0	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current-Gain-Bandwidth Product (2) ( $I_C = 20\text{mA}$ , $V_{CE} = 20\text{Vdc}$ , $f = 100\text{MHz}$ )	$f_T$	300	-	MHz
Input Capacitance ( $V_{EB} = 0.5\text{Vdc}$ , $I_C = 0$ , $f = 1.0\text{MHz}$ )	$C_{ibo}$	-	25	pF
Input Impedance ( $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ ) ( $I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ )	$h_{ie}$	2.0 0.25	8.0 1.25	k $\Omega$
Voltage Feedback Ratio ( $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ ) ( $I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ )	$h_{re}$	- -	8.0 4.0	$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ ) ( $I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ )	$h_{fe}$	50 75	300 375	-
Output Admittance ( $I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ ) ( $I_C = 10\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$ )	$h_{oe}$	5.0 25	35 200	$\mu\text{mhos}$
Collector Base Time Constant ( $I_E = 20\text{mA}$ , $V_{CB} = 20\text{Vdc}$ , $f = 31.8\text{MHz}$ )	$\tau_{b,Cc}$	-	150	ps
Noise Figure ( $I_C = 100\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $R_S = 1.0\text{k}\Omega$ , $f = 1.0\text{kHz}$ )	NF	-	4.0	dB

**SWITCHING CHARACTERISTICS**

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

NOTES : 1. Pulse Test: Pulse Width  $\leq 300\text{ms}$ , Duty Cycle  $\leq 2.0\%$   
2.  $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity

## RATING AND CHARACTERISTICS CURVES ( MMBT2222A )

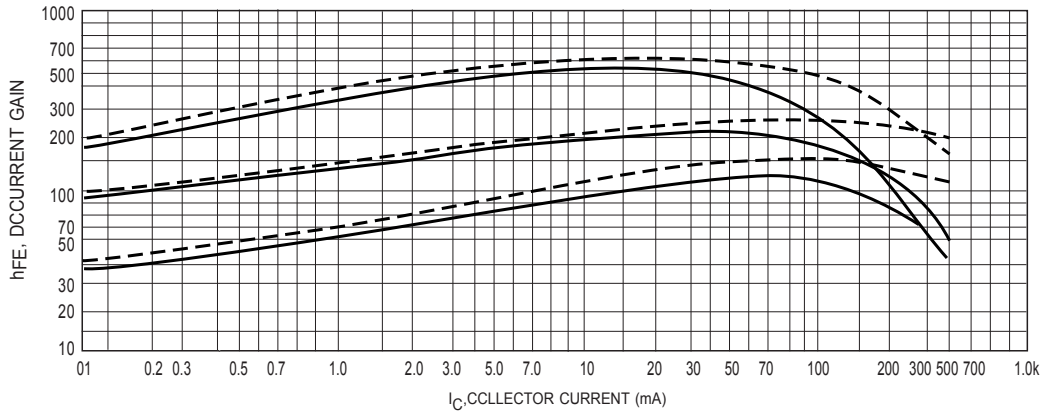


Figure 1. DC Current Gain

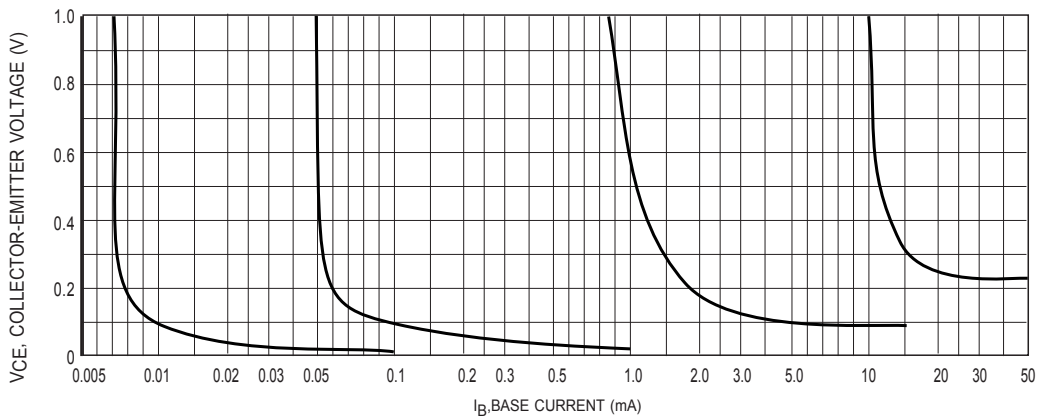


Figure 2. Collector Saturation Region

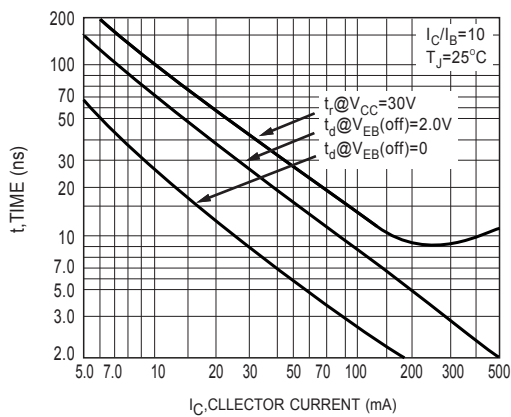


Figure 3. Turn-On Time

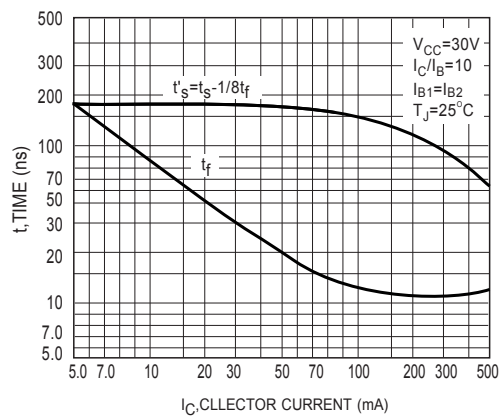


Figure 4. Turn-Off Time

## RATING AND CHARACTERISTICS CURVES ( MMBT2222A )

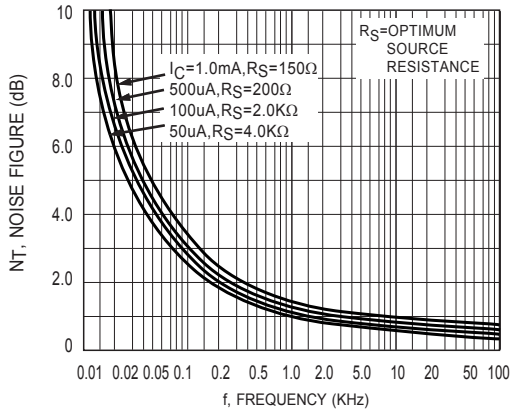


Figure 5. Frequency Effects

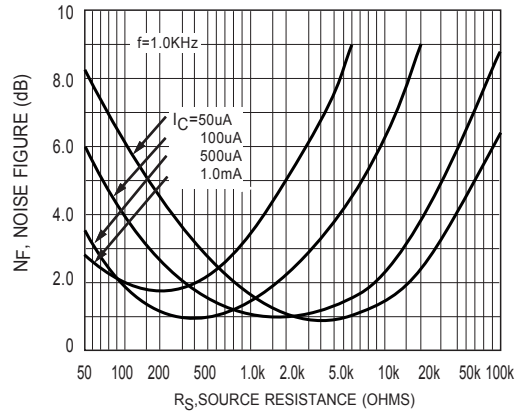


Figure 6. Source Resistance Effects

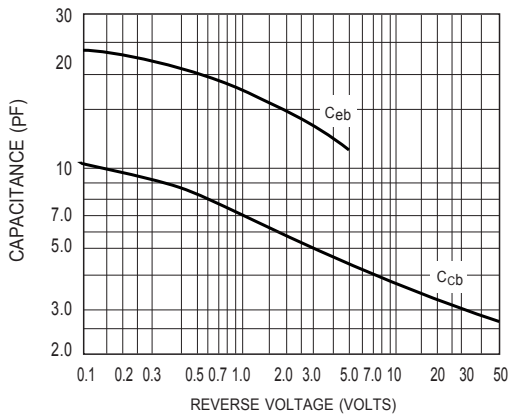


Figure 7. Capacitances

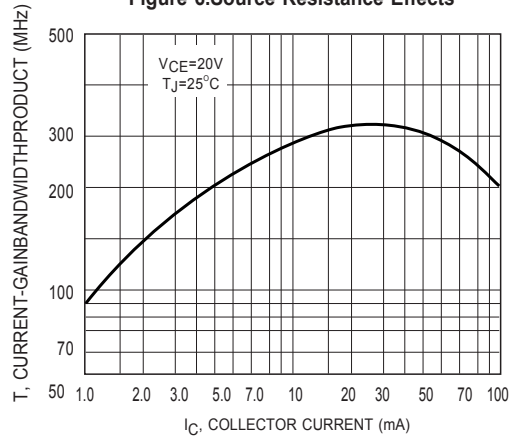


Figure 8. Current-Gain Bandwidth Product

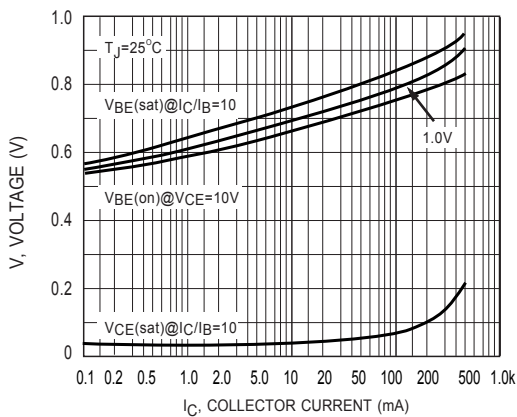


Figure 9. "On" Voltages

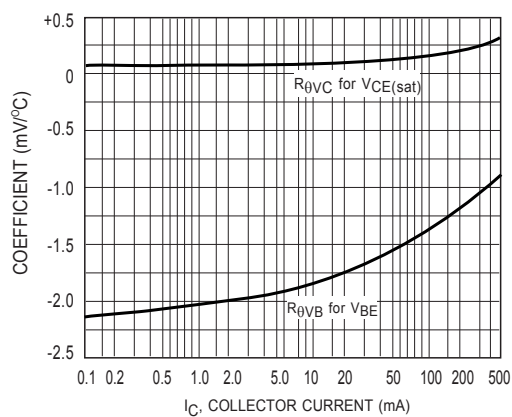


Figure 10. Temperature Coefficients

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