



# MMBT3904

## NPN GENERAL PURPOSE SWITCHING TRANSISTOR

**VOLTAGE** 40 Volt **POWER** 225 mWatt

**SOT-23** Unit : inch(mm)

### FEATURES

- NPN epitaxial silicon, planar design
- Collector-emitter voltage  $V_{CE} = 40V$
- Collector current  $I_C = 200mA$
- Transition frequency  $f_T > 300MHz$  @  $I_C = 10mA_{dc}$ ,  $V_{CE} = 20V_{dc}$ ,  $f = 100MHz$
- Lead free in compliance with EU RoHS 2.0
- Green molding compound as per IEC 61249 standard

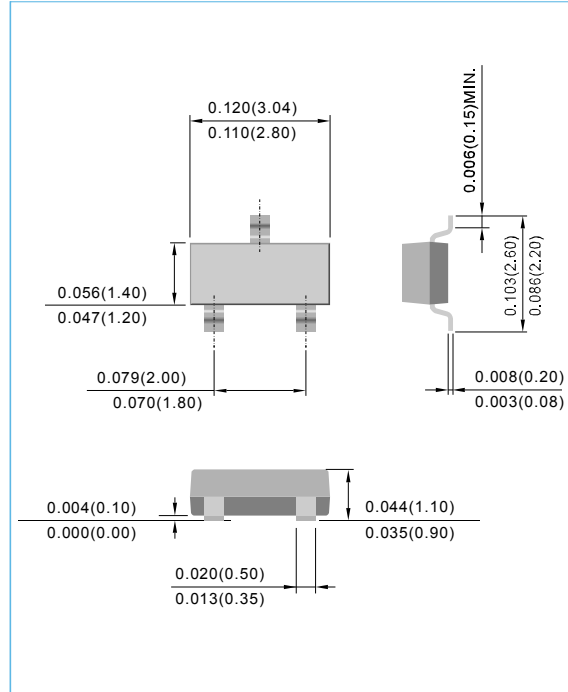
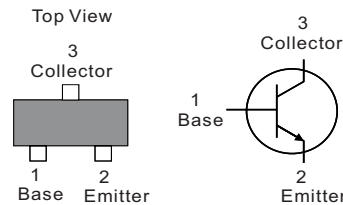
### MECHANICAL DATA

Case: SOT-23, Plastic

Terminals: Solderable per MIL-STD-750, Method 2026

Approx. Weight: 0.0003 ounces, 0.0084 grams

Marking: S1A



### ABSOLUTE RATINGS

PARAMETER	Symbol	Value	Units
Collector - Emitter Voltage	$V_{CEO}$	40	V
Collector - Base Voltage	$V_{CBO}$	60	V
Emitter - Base Voltage	$V_{EBO}$	6.0	V
Collector Current - Continuous	$I_C$	200	mA

### THERMAL CHARACTERISTICS

PARAMETER	Symbol	Value	Units
Max Power Dissipation (Note 1)	$P_{TOT}$	225	mW
Thermal Resistance , Junction to Ambient	$R_{\theta JA}$	556	$^{\circ}C/W$
Junction Temperature	$T_J$	-55 to 150	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55 to 150	$^{\circ}C$

Note 1: Transistor mounted on FR-5 board 1.0 x 0.75 x 0.062 in.



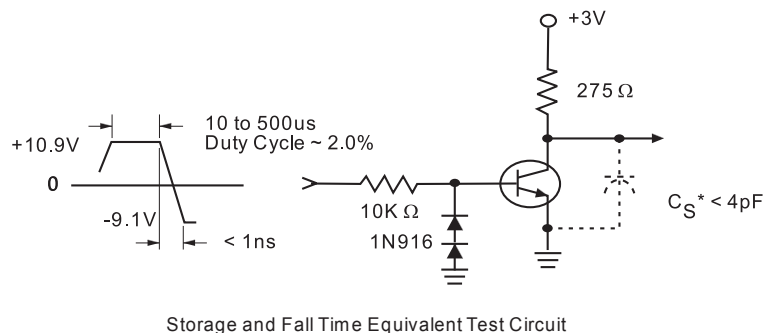
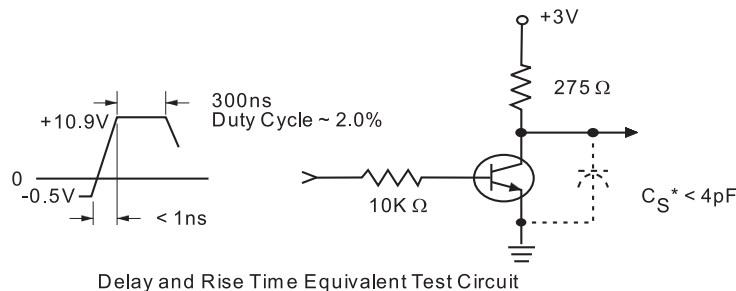
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## ELECTRICAL CHARACTERISTICS

PARAMETER	Symbol	Test Condition	MIN.	TYP.	MAX.	Units
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C=1.0mA, I_B=0$	40	-	-	V
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C=10\mu A, I_E=0$	60	-	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E=10\mu A, I_C=0$	6.0	-	-	V
Base Cutoff Current	$I_{BL}$	$V_{CE}=30V, V_{EB}=3.0V$	-	-	50	nA
Collector Cutoff Current	$I_{CEX}$	$V_{CE}=30V, V_{EB}=3.0V$	-	-	50	nA
DC Current Gain (Note 2)	$h_{FE}$	$I_C=0.1mA, V_{CE}=1.0V$	40	-	-	-
		$I_C=1.0mA, V_{CE}=1.0V$	70	-	-	
		$I_C=10mA, V_{CE}=1.0V$	100	-	300	
		$I_C=50mA, V_{CE}=1.0V$	60	-	-	
		$I_C=100mA, V_{CE}=1.0V$	30	-	-	
Collector - Emitter Saturation Voltage (Note 2)	$V_{CE(SAT)}$	$I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$	-	-	0.2 0.3	V
Base - Emitter Saturation Voltage (Note 2)	$V_{BE(SAT)}$	$I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$	0.65 -	- -	0.85 0.95	V
Collector - Base Capacitance	$C_{CBO}$	$V_{CB}=5V, I_E=0, f=1MHz$	-	-	4.0	pF
Emitter - Base Capacitance	$C_{EBO}$	$V_{EB}=0.5V, I_C=0, f=1MHz$	-	-	8.0	pF
Delay Time	$t_d$	$V_{CC}=3V, V_{BE}=0.5V, I_C=10mA, I_B=1.0mA$	-	-	35	ns
Rise Time	$t_r$	$V_{CC}=3V, V_{BE}=0.5V, I_C=10mA, I_B=1.0mA$	-	-	35	ns
Storage Time	$t_s$	$V_{CC}=3V, I_C=10mA, I_{B1}=I_{B2}=1.0mA$	-	-	200	ns
Fall Time	$t_f$	$V_{CC}=3V, I_C=10mA, I_{B1}=I_{B2}=1.0mA$	-	-	50	ns

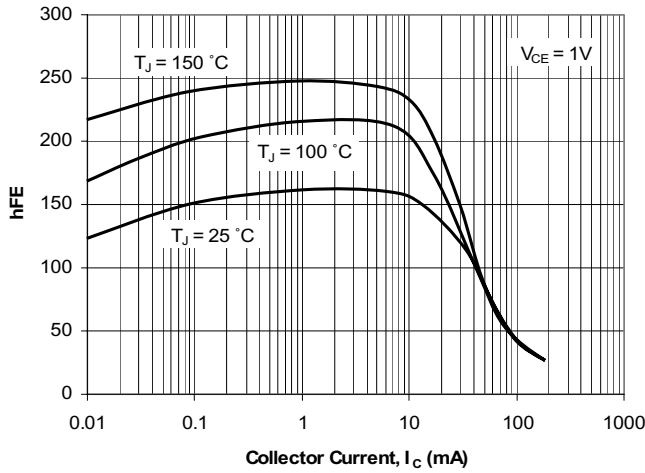
Note 2: Pulse Test: Pulse Width < 300 us, Duty Cycle < 2.0%.

### SWITCHING TIME EQUIVALENT TEST CIRCUITS

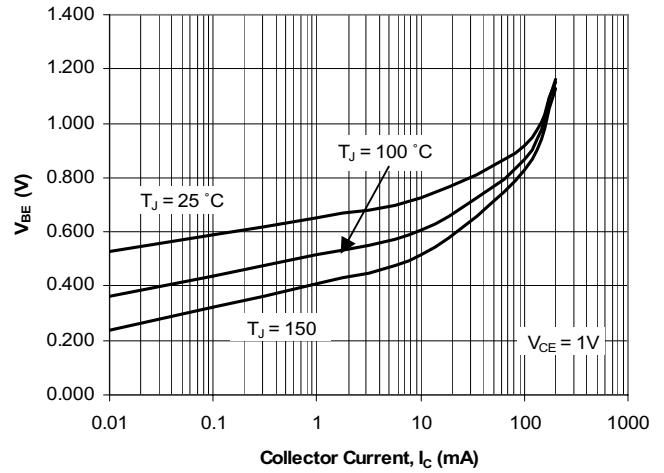




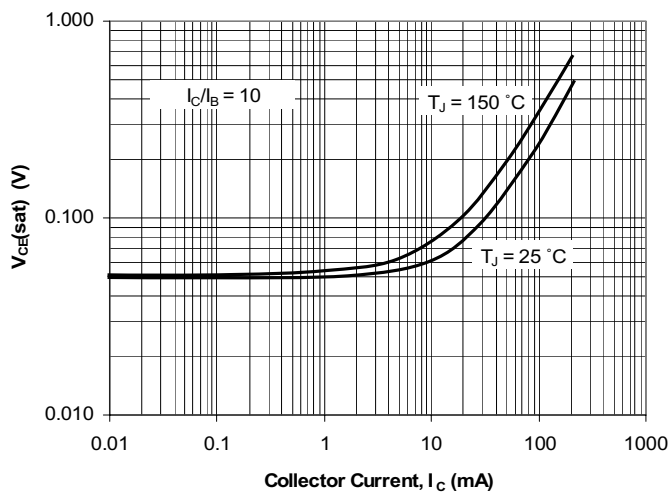
**ELECTRICAL CHARACTERISTICS CURVE**



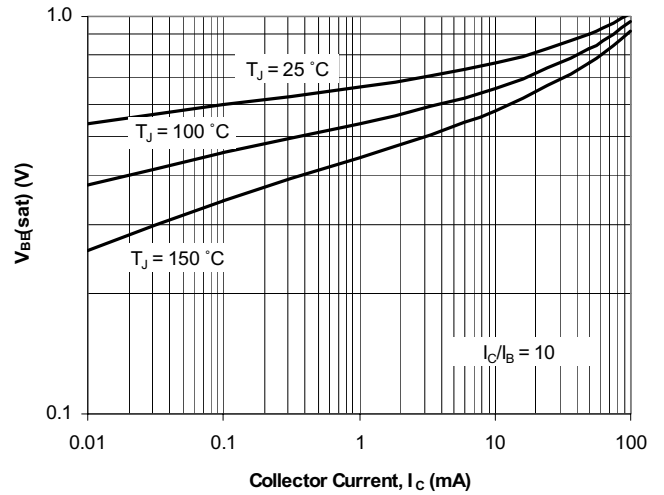
**Fig. 1. Typical hFE vs Collector Current**



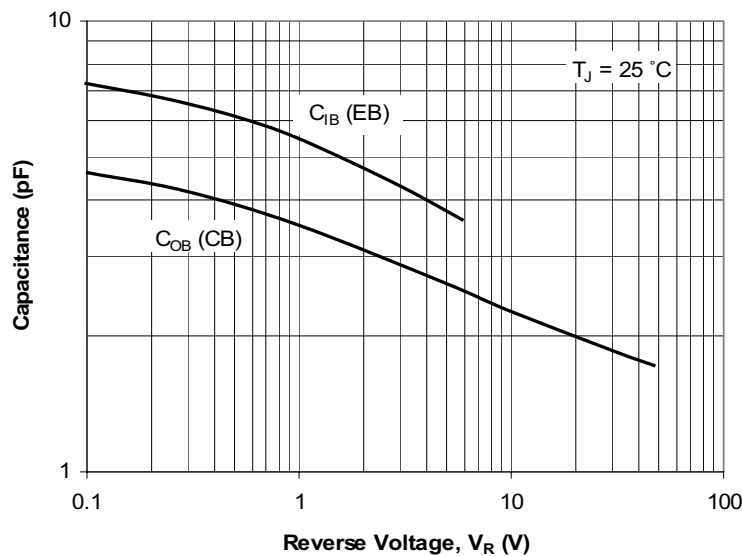
**Fig. 2. Typical VBE vs Collector Current**



**Fig. 3. Typical Vce (sat) vs Collector Current**



**Fig. 4. Typical VBE (sat) vs Collector Current**

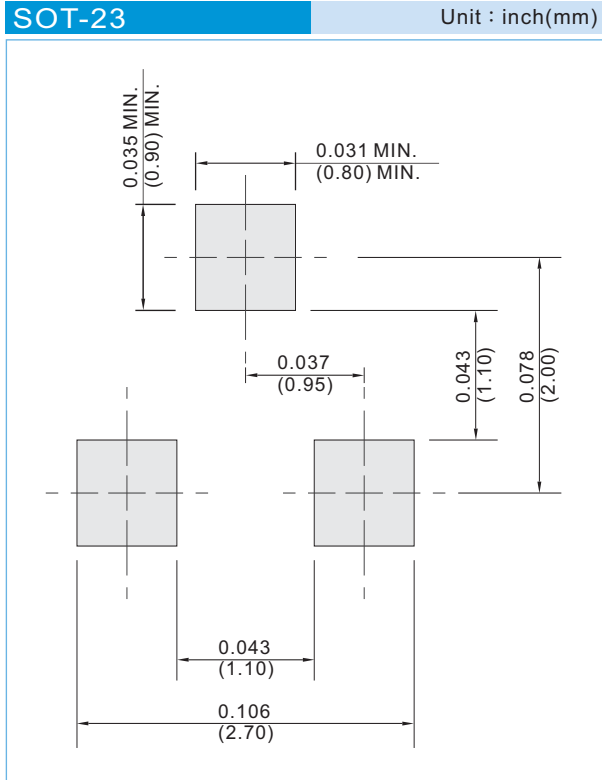


**Fig. 5. Typical Capacitances vs Reverse Voltage**



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## MOUNTING PAD LAYOUT



## ORDER INFORMATION

- Packing information
  - T/R - 12K per 13" plastic Reel
  - T/R - 3K per 7" plastic Reel



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## Part No\_packing code\_Version

MMBT3904\_R1\_00001

MMBT3904\_R2\_00001

For example :

**RB500V-40\_R2\_00001**



Packing Code <b>XX</b>				Version Code <b>XXXXX</b>		
Packing type	1 <sup>st</sup> Code	Packing size code	2 <sup>nd</sup> Code	HF or RoHS	1 <sup>st</sup> Code	2 <sup>nd</sup> ~5 <sup>th</sup> Code
Tape and Ammunition Box (T/B)	<b>A</b>	N/A	<b>0</b>	<b>HF</b>	<b>0</b>	serial number
Tape and Reel (T/R)	<b>R</b>	7"	<b>1</b>	<b>RoHS</b>	<b>1</b>	serial number
Bulk Packing (B/P)	<b>B</b>	13"	<b>2</b>			
Tube Packing (T/P)	<b>T</b>	26mm	<b>X</b>			
Tape and Reel (Right Oriented) (TRR)	<b>S</b>	52mm	<b>Y</b>			
Tape and Reel (Left Oriented) (TRL)	<b>L</b>	PANASERT T/B CATHODE UP (PBCU)	<b>U</b>			
FORMING	<b>F</b>	PANASERT T/B CATHODE DOWN (PBCD)	<b>D</b>			



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