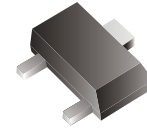


## MMBT3904M-HF (NPN)

RoHS Device  
Halogen Free



### Features

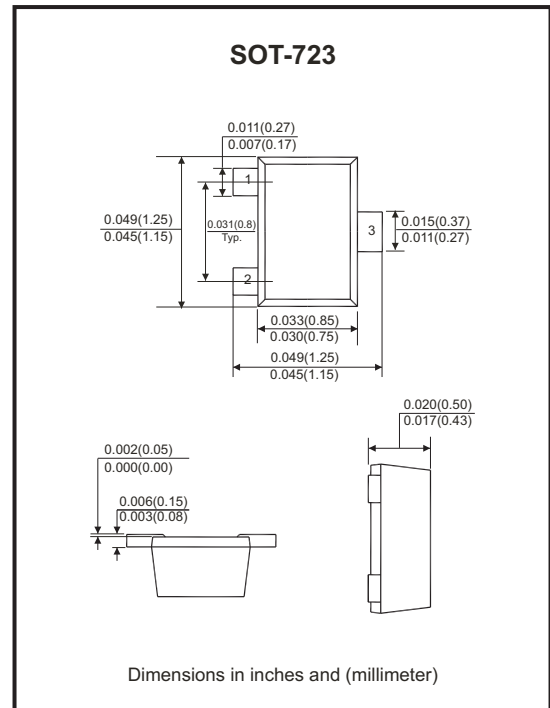
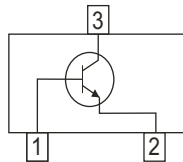
- Small package.

### Mechanical data

- Case: SOT-723, molded plastic.
- Terminals: Solderable per MIL-STD-750, method 2026.

### Circuit Diagram

- 1.BASE
- 2.EMITTER
- 3.COLLECTOR



### Maximum Ratings (at TA=25°C unless otherwise noted)

Parameter	Conditions	Symbol	Value	Unit
Collector-Base voltage		V <sub>CB0</sub>	60	V
Collector-Emitter voltage		V <sub>CE0</sub>	40	V
Emitter-Base voltage		V <sub>EB0</sub>	6	V
Collector current-continuous		I <sub>c</sub>	0.2	A
Power dissipation		P <sub>c</sub>	0.1	W
Thermal resistance	junction to ambient	R <sub>θJA</sub>	1250	°C/W
Junction temperature		T <sub>J</sub>	150	°C
Storage temperature range		T <sub>stg</sub>	-55~+150	°C

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

Parameter	Symbol	Conditions	Min	Max	Unit
Collector-Base breakdown voltage	$V_{(BR)CBO}$	$I_C=10\mu\text{A}, I_E=0$	60		V
Collector-Emitter breakdown voltage	$V_{(BR)CEO}$	$I_C=1\text{mA}, I_B=0$	40		V
Emitter-Base breakdown voltage	$V_{(BR)EBO}$	$I_E=10\mu\text{A}, I_C=0$	6		V
Collector cut-off current	$I_{CEX}$	$V_{CE}=30\text{V}, V_{EB(off)}=3\text{V}$		50	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB}=5\text{V}, I_C=0$		100	nA
DC current gain	$h_{FE(1)}$	$V_{CE}=1\text{V}, I_C=0.1\text{mA}$	40		
	$h_{FE(2)}$	$V_{CE}=1\text{V}, I_C=1\text{mA}$	70		
	$h_{FE(3)}$	$V_{CE}=1\text{V}, I_C=10\text{mA}$	100	300	
	$h_{FE(4)}$	$V_{CE}=1\text{V}, I_C=50\text{mA}$	60		
Collector-Emitter saturation voltage	$V_{CE(sat)1}$	$I_C=10\text{mA}, I_B=1\text{mA}$		0.2	V
	$V_{CE(sat)2}$	$I_C=50\text{mA}, I_B=5\text{mA}$		0.3	V
Base-Emitter saturation voltage	$V_{BE(sat)1}$	$I_C=10\text{mA}, I_B=1\text{mA}$	0.65	0.85	V
	$V_{BE(sat)2}$	$I_C=50\text{mA}, I_B=5\text{mA}$		0.95	V
Transition frequency	$f_T$	$V_{CE}=20\text{V}, I_C=10\text{mA}, f=100\text{MHz}$	300		MHz
Output capacitance	$C_{Ob}$	$V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$		4	pF
Input capacitance	$C_{ib}$	$V_{EB}=0.5\text{V}, I_C=0, f=1\text{MHz}$		8	pF
Noise figure	NF	$V_{CE}=5\text{V}, I_C=0.1\text{mA}, f=1\text{MHz}, R_S=1\text{K}\Omega$		5	dB
Delay time	$t_d$	$V_{CC}=3\text{V}, V_{BE(off)}=-0.5\text{V}$		35	nS
Rise time	$t_r$	$I_C=10\text{mA}, I_{B1}=1\text{mA}$		35	nS
Storage time	$t_s$	$V_{CC}=3\text{V}, I_C=10\text{mA}$		200	nS
Fall time	$t_f$	$I_{B1}=I_{B2}=1\text{mA}$		50	nS

## RATING AND CHARACTERISTIC CURVES (MMBT3904M-HF)

Fig.1 - Static Characteristic

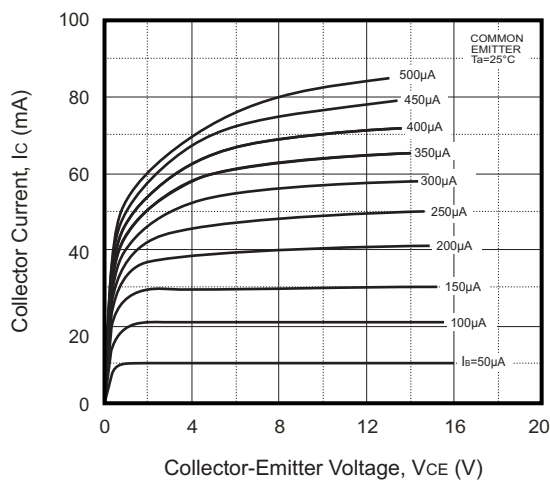
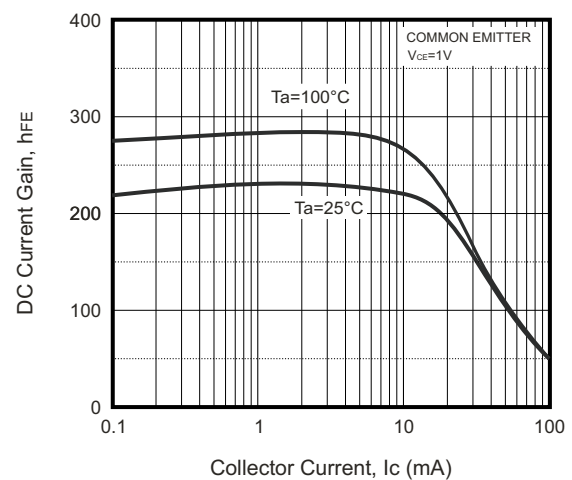


Fig.2 -  $h_{FE} - I_C$



## RATING AND CHARACTERISTIC CURVES (MMBT3904M-HF)

Fig.3 -  $V_{CEsat} - I_c$

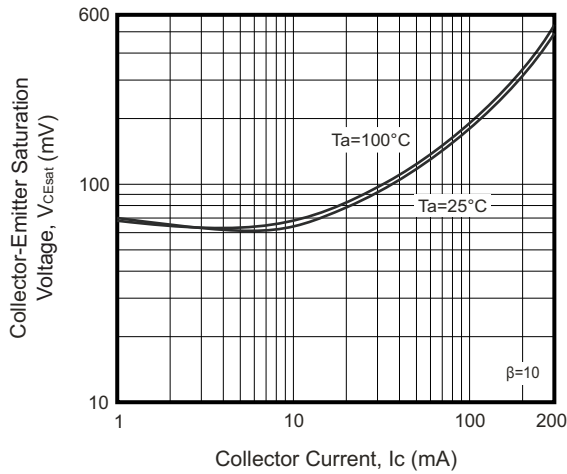


Fig.4 -  $V_{BEsat} - I_c$

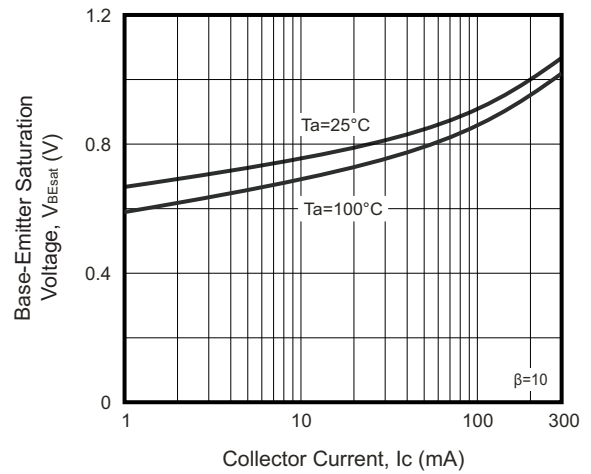


Fig.5 -  $I_c - V_{BE}$

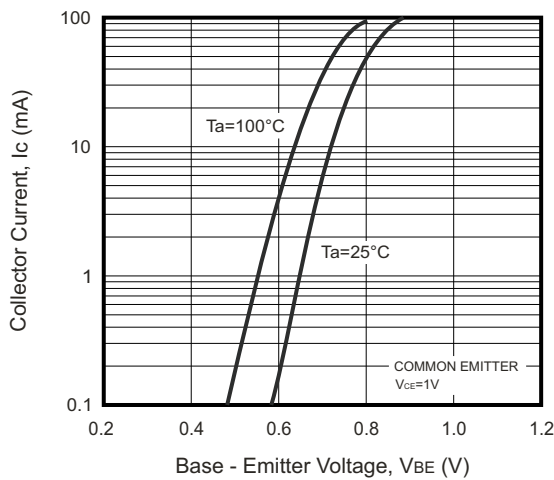


Fig.6 -  $C_{ob}/C_{ib} - V_{CB}/V_{EB}$

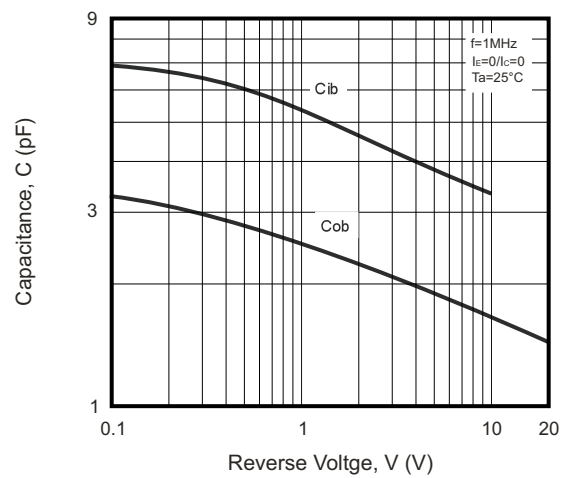


Fig.7 -  $F_T - I_c$

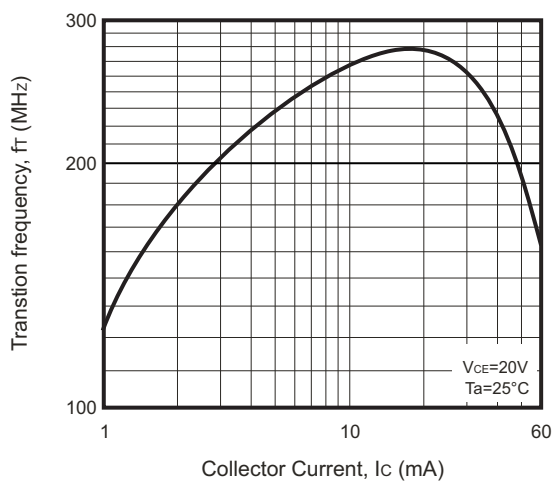
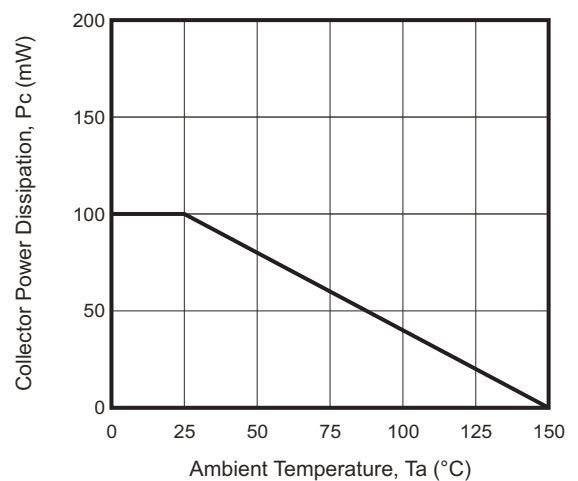
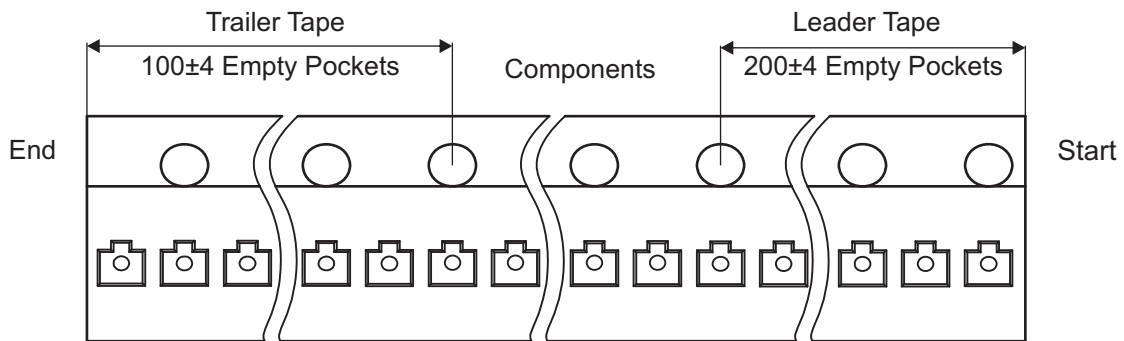
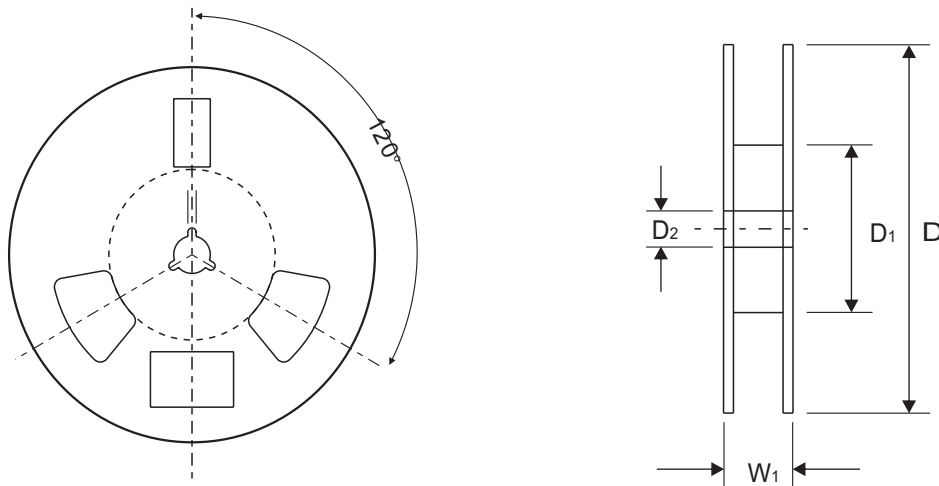
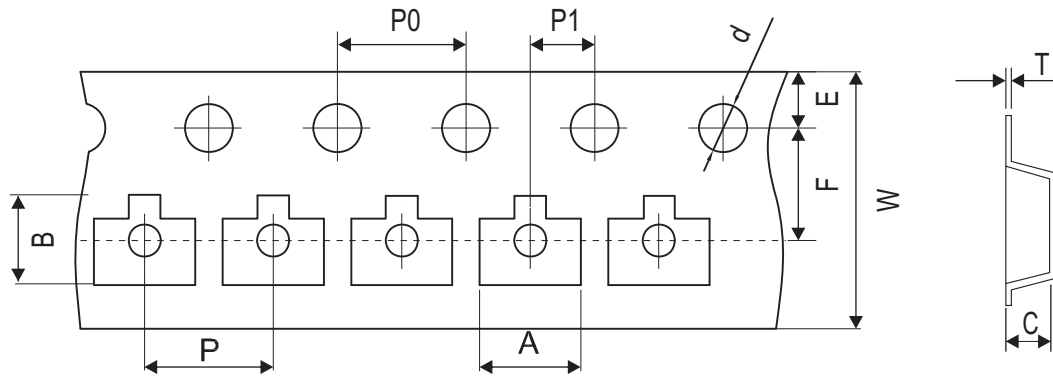


Fig.8 -  $P_c - T_a$



## Reel Taping Specification



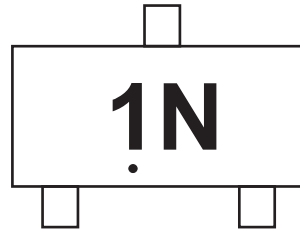
SOT-723	SYMBOL	A	B	C	d	D	D1	D2
	(mm)	1.33 ± 0.05	1.45 ± 0.05	0.61 ± 0.05	1.50 ± 0.10	178.00 ± 2.00	54.40 ± 1.00	13.00 ± 1.00
	(inch)	0.052 ± 0.002	0.057 ± 0.002	0.024 ± 0.002	0.059 ± 0.004	7.008 ± 0.078	2.142 ± 0.039	0.512 ± 0.039

SOT-723	SYMBOL	E	F	P	P0	P1	W	W1
	(mm)	1.75 ± 0.10	3.50 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	8.00 + 0.30 / - 0.10	12.30 ± 1.00
	(inch)	0.069 ± 0.004	0.138 ± 0.004	0.079 ± 0.004	0.158 ± 0.004	0.079 ± 0.004	0.315 + 0.012 / - 0.004	0.484 ± 0.039

Company reserves the right to improve product design, functions and reliability without notice.

## Marking Code

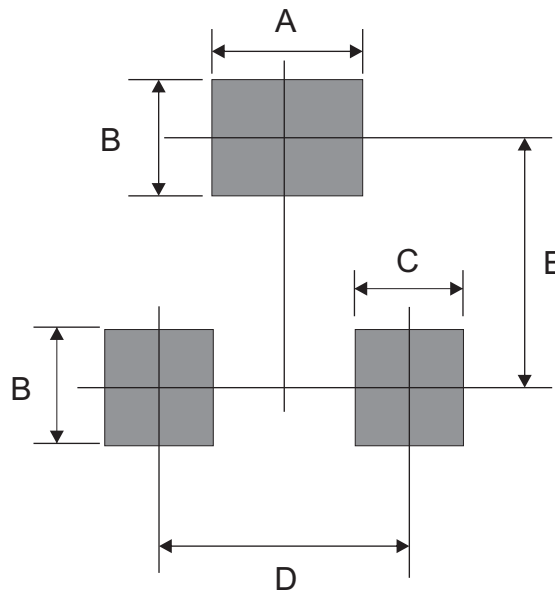
Part Number	Marking Code
MMBT3904M-HF	1N



Solid dot “.” = Halogen Free

## Suggested PAD Layout

SIZE	SOT-723	
	(mm)	(inch)
A	0.42	0.017
B	0.30	0.012
C	0.32	0.013
D	0.80	0.031
E	1.00	0.039



Note:  
 1. General tolerance:  $\pm 0.05\text{mm}$ .  
 2. The pad layout is for reference purposes only.

## Standard Packaging

Case Type	REEL PACK	
	REEL ( pcs )	Reel Size (inch)
SOT-723	8,000	7