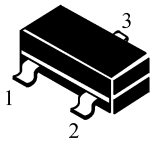
MMBT3904

NPN Switching Transistor

SOT—23

1. BASE
2. EMITTER
3. COLLECTOR



■MAXIMUM RATINGS

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	40	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	6.0	Vdc
Collector Current-Continuous	Ic	200	mAdc

■THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board(1) Derate above25℃	P_D	225 1.8	mW mW/℃
Total Device Dissipation Alumina Substrate, Derate above25℃	P_D	300 2.4	mW mW/℃
Thermal Resistance Junction to Ambient	$R_{\Theta JA}$	417	℃/W
Solder Temperature/Solder Time	T/t	260/10	℃/S
Junction and Storage Temperature	T_J,T_{stg}	150℃, -55to+150℃	

■ELECTRICAL CHARACTERISTICS

(T_A=25℃ unless otherwise noted)

■OFF CHARACTERISTICS

Characteristic	Symbol	Min	Max	Unit
Collector-Emitter Breakdown Voltage(3) (I_C=1.0mAdc,I_B=0)	$V_{(BR)CEO}$	40	—	Vdc
Collector-Base Breakdown Voltage (I_C=10 μ Adc,I_E=0)	$V_{(BR)CBO}$	60	—	Vdc
Emitter-Base Breakdown Voltage (I_E=10 μ Adc,I_C=0)	$V_{(BR)EBO}$	6.0	—	Vdc
Base Cutoff Current (V_{CE}=30Vdc, V_{EB} =3.0 Vdc)	I_{BEX}	—	50	nAdc
Collector Cutoff Current (V_{CE}=30Vdc, V_{EB} =3.0Vdc)	I_{CEX}	—	50	nAdc

■ON CHARCTERISTICS(2)

Characteristic	Symbol	Min	Max	Unit
DC Current Gain	h_{PE}			—
(I_C=0.1mAdc,V_{CE}=1.0Vdc)		40	—	
(I_C=1.0mAdc,V_{CE}=1.0Vdc)		70	—	
(I_C=10mAdc,V_{CE}=1.0Vdc)		100	300	
(I_C=50mAdc,V_{CE}=1.0Vdc)		60	—	
(I_C=100mAdc,V_{CE}=1.0Vdc)		30	—	
Collector-Emitter Saturation Voltage (I_C=10mAdc, I_B=1.0mAdc) (I_C=50mAdc, I_B=5.0mAdc)	$V_{CE(sat)}$	 — —	 0.25 0.4	Vdc
Base-Emitter Saturation Voltage (I_C=10mAdc, I_B=1.0mAdc) (I_C=50mAdc, I_B=5.0mAdc)	$V_{BE(sat)}$	 0.65 —	 0.85 0.95	Vdc

■SMALL-SIGNAL CHARACTERISTICS

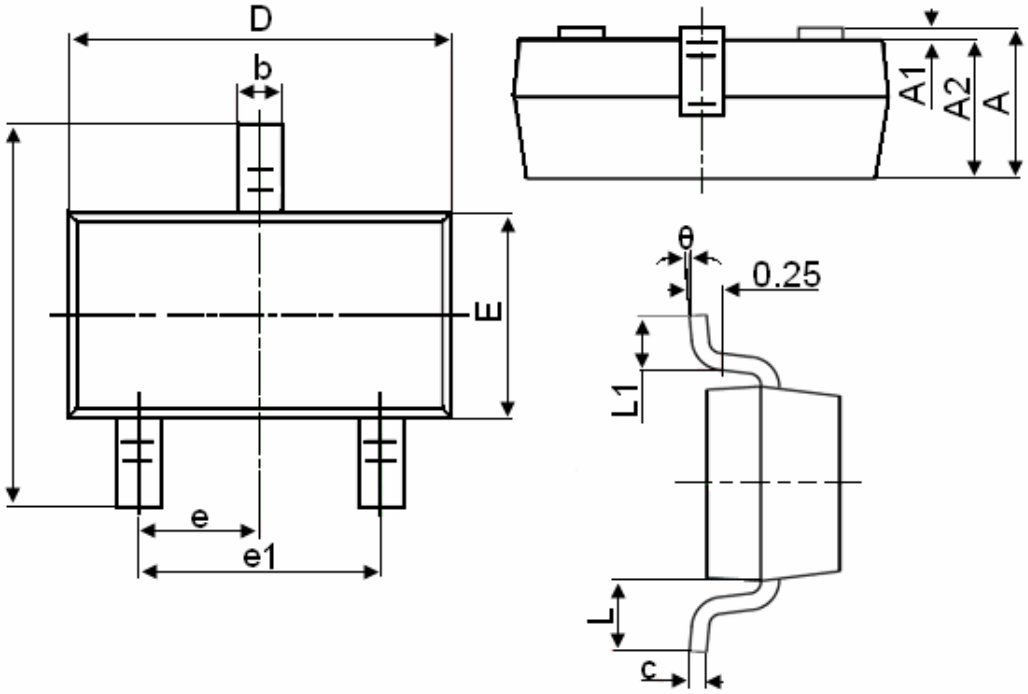
Characteristic	Symbol	Min	Max	Unit
Current-Gain-Bandwidth Product (I_c=10mAdc,V_{CE}=-20Vdc,f=100MHz)	f_T	300	—	MHz
Output Capacitance (V_{CB}=5.0Vdc, I_E=0, f=1.0MHz)	C_{obo}	—	4.0	pF
Input Capacitance (V_{EB}=0.5Vdc, I_C=0, f=1.0MHz)	C_{ibo}	—	8.0	pF
Input Impedance (V_{CE}=10Vdc, I_C=1.0mAdc, f=1.0KHz)	h_{ie}	1.0	10	kΩ
Voltage Feedback Ratio (V_{CE}=10Vdc, I_C=1.0mAdc, f=1.0KHz)	h_{re}	0.5	8.0	$\times10^{-4}$
Small-Signal Current Gain (V_{CE}=10Vdc, I_C=1.0mAdc, f=1.0KHz)	h_{fe}	100	400	—
Output Admittance (V_{CE}=10Vdc, I_C=1.0mAdc, f=1.0KHz)	h_{oe}	1.0	40	μmhos
Noise Figure (V_{CE}=5.0Vdc, I_C=100μAdc,Rs=1.0 kΩ f=1.0KHz)	NF	—	5.0	dB

■SWITCHING CHARACTERISTICS

Characteristic		Symbol	Min	Max	Unit
Delay Time	(V_{CC}=3.0Vdc,V_{BE}=0.5Vdc, I_C=10mAdc, I_{B1}=1.0mAdc)	t_d	—	35	ns
Rise Time		t_r	—	35	
Storage Time	(V_{CC}=3.0Vdc,I_C=10mAdc, I_{B1}=I_{B2}=1.0mAdc)	t_s	—	225	ns
Fall Time		t_f	—	75	

1. FR-5=1.0×0.75×0.062in.
2. Alumina=0.4×0.3×0.024in.99.5%alumina.
3. Pulse Width≤300us;Duty Cycle≤2.0%.
4. Pulse Test: Pulse Width≤300us;Duty Cycle≤2.0%.

SOT-23 Package Information



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°