MMBT3904

NPN General Purpose Amplifier

Features

- Collector current capability IC = -200 mA
- Collector-emitter voltage VCEO = -40 V
- RoHS compliant package

Application

- General switching and amplification

Mechanical Data

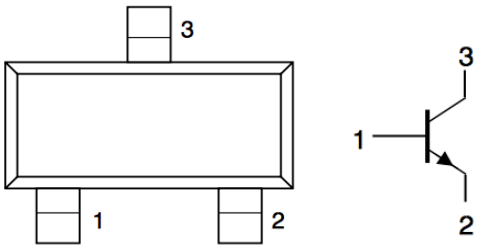
Case outline: SOT-23

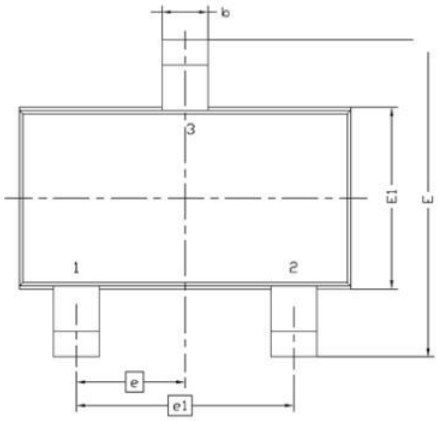
Packing & Order Information

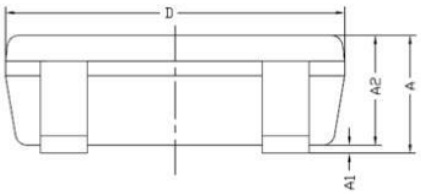
3,000/Reel

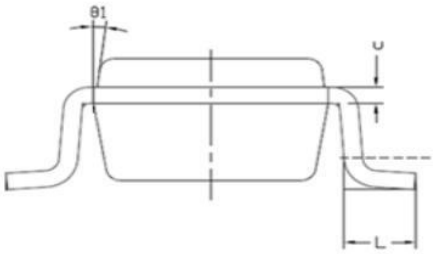
RoHS
COMPLIANT

Graphic symbol









Symbol	MILLIMETERS	
	MIN	MAX
A	0.8	1.2
A1	0	0.1
A2	0.7	1.1
b	0.3	0.5
c	0.1	0.2
D	2.7	3.1
E	2.6	3
E1	1.4	1.8
e	0.95 BSC	
e1	1.9 BSC	
L	0.3	0.6
θ1	7° NOM	

MMBT3904

NPN General Purpose Amplifier

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

MAXIMUM RATINGS			
Symbol	Characteristic	Rating	Unit
V_{CBO}	Collector-Base Voltage	40	Vdc
V_{CEO}	Collector-Emitter Voltage	60	Vdc
V_{EBO}	Emitter-Base Voltage	6	Vdc
I_C	Collector Current -Continuous	200	mAdc

THERMAL CHARACTERISTICS			
Symbol	Characteristic	Max	Unit
P_D	Total Device Dissipation FR-5 Board(1) TA=25°C Derate above 25°C	 225 1.8	 mW mW/°C

THERMAL CHARACTERISTICS			
Symbol	Characteristic	Rating	Unit
P_D	Total Device Dissipation Alumina Substrate TA=25°C Derate above 25°C	 300 2.4	 mW mW/°C
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	417	°C/W
T_J,Tstg	Junction and Storage Temperature	150°C, -55 to + 150°C	

ELECTRICAL CHARACTERISTICS @ Ta=25°C unless otherwise specified

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

MMBT3904

NPN General Purpose Amplifier

ON CHARACTERISTICS				
Symbol	Characteristic	Min	Max	Unit
h_{PE}	DC Current Gain			--
	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	--	

ON CHARACTERISTICS				
Symbol	Characteristic	Min	Max	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage (I_C = 10mAdc ,V_B = 1.0 mAdc) (I_C = 50mAdc ,V_B = 5.0 mAdc)	 -- --	 0.25 0.4	Vdc

ON CHARACTERISTICS				
Symbol	Characteristic	Min	Max	Unit
$V_{CE(sat)}$	Base-Emitter Saturation Voltage (I_C = 10mAdc , V_B = 1.0 mAdc) (I_C = 50mAdc , V_B = 5.0 mAdc)	0.65 --	0.85 0.95	Vdc

SMALL-SIGNAL CHARACTERISTICS				
Symbol	Characteristic	Min	Max	Unit
f_T	Current-Gain-Bandwidth Product (I_C = 10mAdc , V_{CE} = 20Vdc , f= 100MHz)	300	--	MHZ
C_{obo}	Output Capacitance (V_{CB} = 5.0Vdc , I_E = 0 , f = 1.0MHz)	--	4.0	pF
C_{ibo}	Input Capacitance (V_{EB} = 0.5Vdc , I_C=0 , f = 1.0MHz)	--	8.0	pF
Hie	Input Impedance (V_{CE} = 10Vdc , I_C= 1.0mAdc , f = 1.0KHz)	1.0	10	kΩ
Hre	Voltage Feedback Ration (V_{CE} = 10Vdc , I_C= 1.0mAdc , f = 1.0KHz)	0.5	8.0	$\times 10^{-4}$
Hfe	Small-Signal Current Gain (V_{CE} = 10Vdc , I_C= 1.0mAdc , f = 1.0KHz)	100	400	--
Hoe	Output Admittance (V_{CE} = 10Vdc , I_C= 1.0mAdc , f = 1.0KHz)	1.0	40	μmhos
NF	Noise Figure (V_{CE} = 5.0Vdc , I_C = 100μAdc , Rs = 1.0kΩf = 1.0KHz)	--	5.0	dB

MMBT3904

NPN General Purpose Amplifier

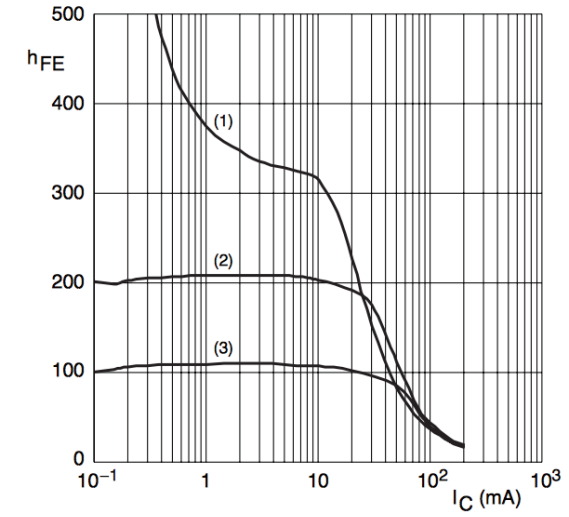
SMALL-SIGNAL CHARACTERISTICS					
Symbol	Characteristic		Min	Max	Unit
t_d	Delay Time	(V_{CC} = 3.0Vdc , V_{BE} = 0.5Vdc,	--	35	ns
t_r	Rise Time	I_C = 10mAdc , I_{B1} = 1.0mAdc)	--	35	ns
t_s	Storage Time	(V_{CC} = 3.0Vdc, I_C = 10 mAdc,	--	225	ns
t_f	Fall Time	I_{B1}=I_{B2}= 1.0mAdc)	--	75	ns

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%

MMBT3904

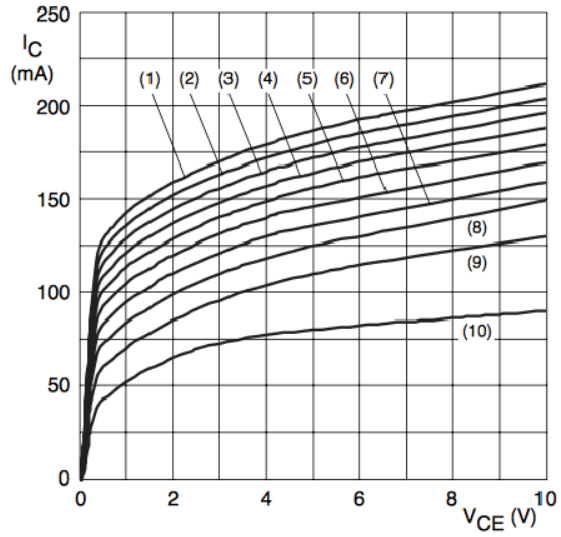
NPN General Purpose Amplifier

■Characteristics Curve



V_{CE} = 1 V.
(1) T_{amb} = 150 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = –55 °C.

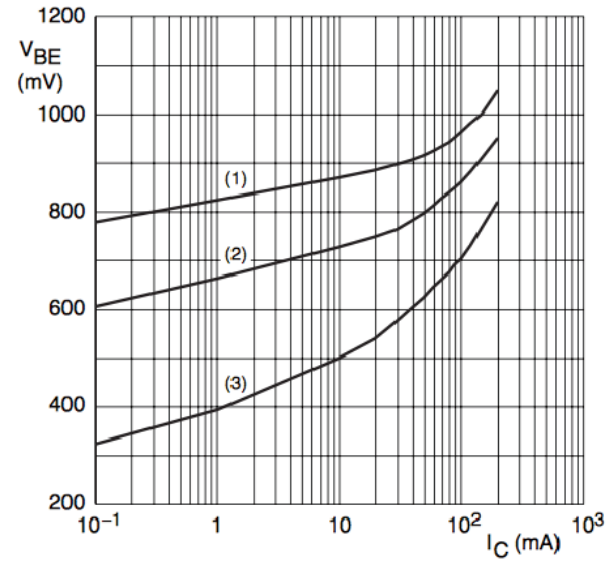
FIG.1-DC current gain; typical values



T_{amb} = 25 °C.

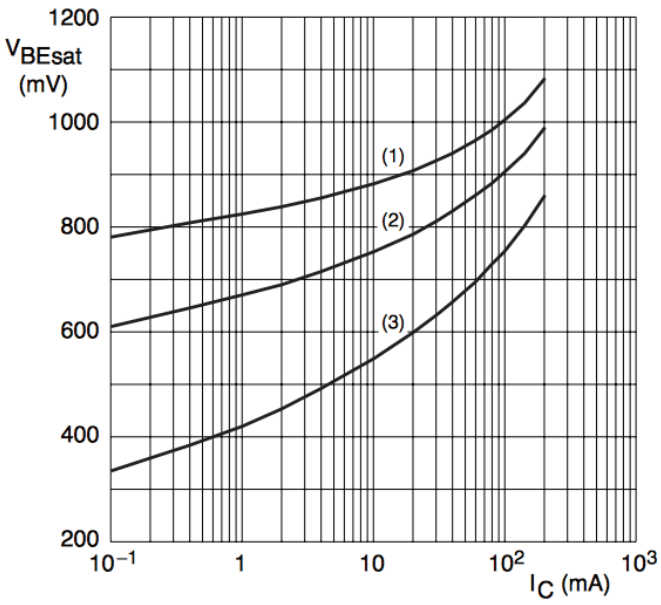
(1) I_B = 5 mA.
(2) I_B = 4.5 mA.
(3) I_B = 4 mA.
(4) I_B = 3.5 mA.
(5) I_B = 3 mA.
(6) I_B = 2.5 mA.
(7) I_B = 2 mA.
(8) I_B = 1.5 mA.
(9) I_B = 1 mA.
(10) I_B = 0.5 mA.

FIG.2-Collector current as a function of collector-emitter voltage.



V_{CE} = 1 V.
(1) T_{amb} = –55 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 150 °C.

FIG.3-Base-emitter voltage as a function of collector current.



I_C/I_B = 10.
(1) T_{amb} = –55 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 150 °C.

FIG.4-Base-emitter saturation voltage as a function of collector current.

MMBT3904

NPN General Purpose Amplifier

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Bruckewell Technology Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Bruckewell”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Bruckewell makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Bruckewell disclaims

(i) Any and all liability arising out of the application or use of any product.

(ii) Any and all liability, including without limitation special, consequential or incidental damages.

(iii) Any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Bruckewell’s knowledge of typical requirements that are often placed on Bruckewell products in generic applications.

Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time.

Product specifications do not expand or otherwise modify Bruckewell’s terms and conditions of purchase, including but not limited to the warranty expressed therein.