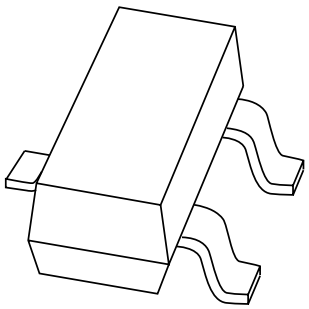
DATA SHEET



MMBT3906
PNP switching transistor

Product data sheet
Supersedes data of 2000 Apr 11

2003 Mar 18

PNP switching transistor MMBT3906

FEATURES

- Collector current capability I_C = −200 mA
- Collector-emitter voltage V_{CEO} = −40 V.

APPLICATIONS

- General switching and amplification.

DESCRIPTION

PNP switching transistor in a SOT23 plastic package.
NPN complement: MMBT3904.

MARKING

TYPE NUMBER	MARKING CODE(1)
MMBT3906	7B∗

Note

1. ∗ = p: Made in Hong Kong.
   ∗ = t: Made in Malaysia.
   ∗ = W: Made in China.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{CEO}	collector-emitter voltage	−40	V
I_C	collector current (DC)	−200	mA

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

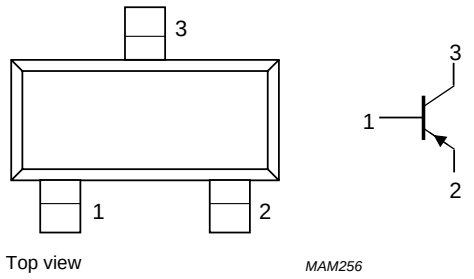


Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−40	V
V_{CEO}	collector-emitter voltage	open base	–	−40	V
V_{EBO}	emitter-base voltage	open collector	–	−6	V
I_C	collector current (DC)		–	−200	mA
I_{CM}	peak collector current		–	−200	mA
I_{BM}	peak base current		–	−100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C; note 1	–	250	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		−65	+150	°C

Note

1. Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	500	K/W

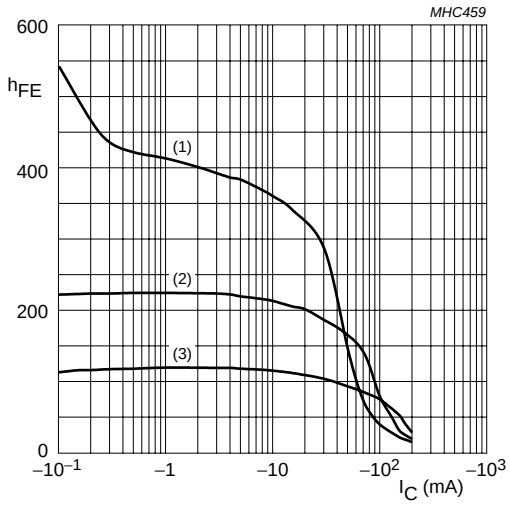
Note

1. Transistor mounted on an FR4 printed-circuit board.

CHARACTERISTICS

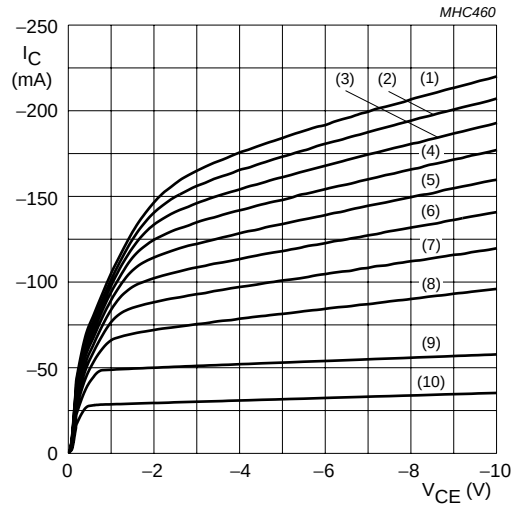
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –30 V	–	–50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –6 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –1 V; see Fig.2			
		I_C = –0.1 mA	60	–	
		I_C = –1 mA	80	–	
		I_C = –10 mA	100	300	
		I_C = –50 mA	60	–	
		I_C = –100 mA	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–	–250	mV
		I_C = –50 mA; I_B = –5 mA	–	–400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = –10 mA; I_B = –1 mA	–	–850	mV
		I_C = –50 mA; I_B = –5 mA	–	–950	mV
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –5 V; f = 1 MHz	–	4.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –500 mV; f = 1 MHz	–	10	pF
f_T	transition frequency	I_C = –10 mA; V_{CE} = –20 V; f = 100 MHz	250	–	MHz
F	noise figure	I_C = –100 μA; V_{CE} = –5 V; R_S = 1 kΩ; f = 10 Hz to 15.7 kHz	–	4	dB
Switching times (between 10% and 90% levels); see Fig.7					
t_d	delay time	I_{Con} = –10 mA; I_{Bon} = –1 mA; I_{Boff} = 1 mA	–	35	ns
t_r	rise time		–	35	ns
t_s	storage time		–	225	ns
t_f	fall time		–	75	ns



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

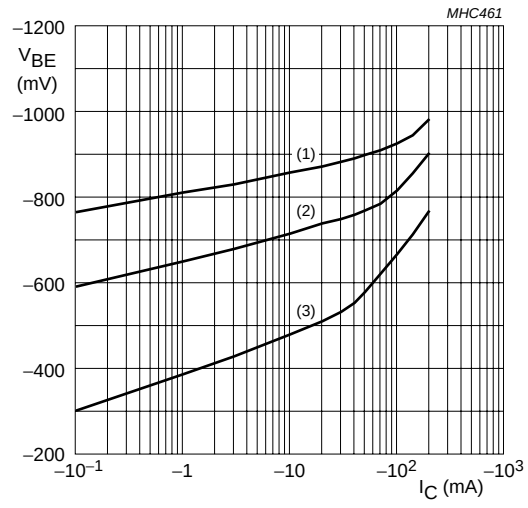
Fig.2 DC current gain; typical values.



T_{amb} = 25 °C.

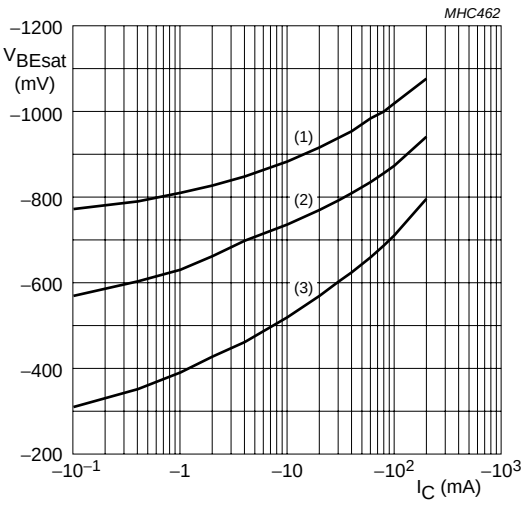
(1) I_B = −1.5 mA.
(2) I_B = −1.35 mA.
(3) I_B = −1.2 mA.
(4) I_B = −1.05 mA.
(5) I_B = −0.9 mA.
(6) I_B = −0.75 mA.
(7) I_B = −0.6 mA.
(8) I_B = −0.45 mA.
(9) I_B = −0.3 mA.
(10) I_B = −0.15 mA.

Fig.3 Collector current as a function of collector-emitter voltage.



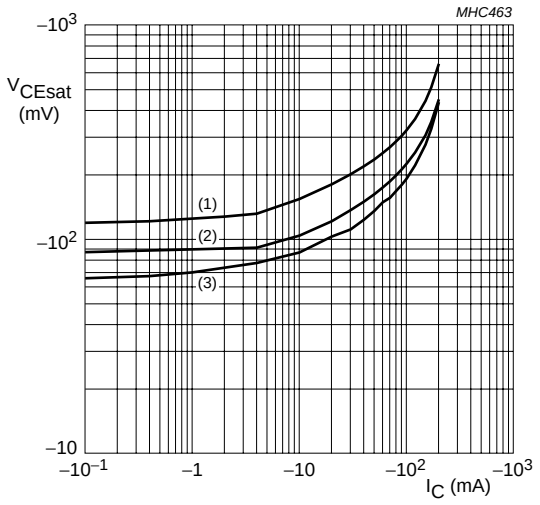
V_{CE} = −1 V.
(1) T_{amb} = −55 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 150 °C.

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



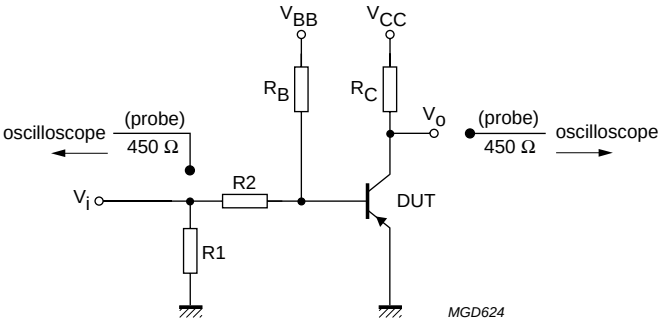
I_C/I_B = 10.
(1) T_{amb} = −55 °C.
(2) T_{amb} = 25 °C.
(3) T_{amb} = 150 °C.

Fig.5 Base-emitter saturation voltage as a function of collector current.



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

Fig.6 Collector-emitter saturation voltage as a function of collector current.

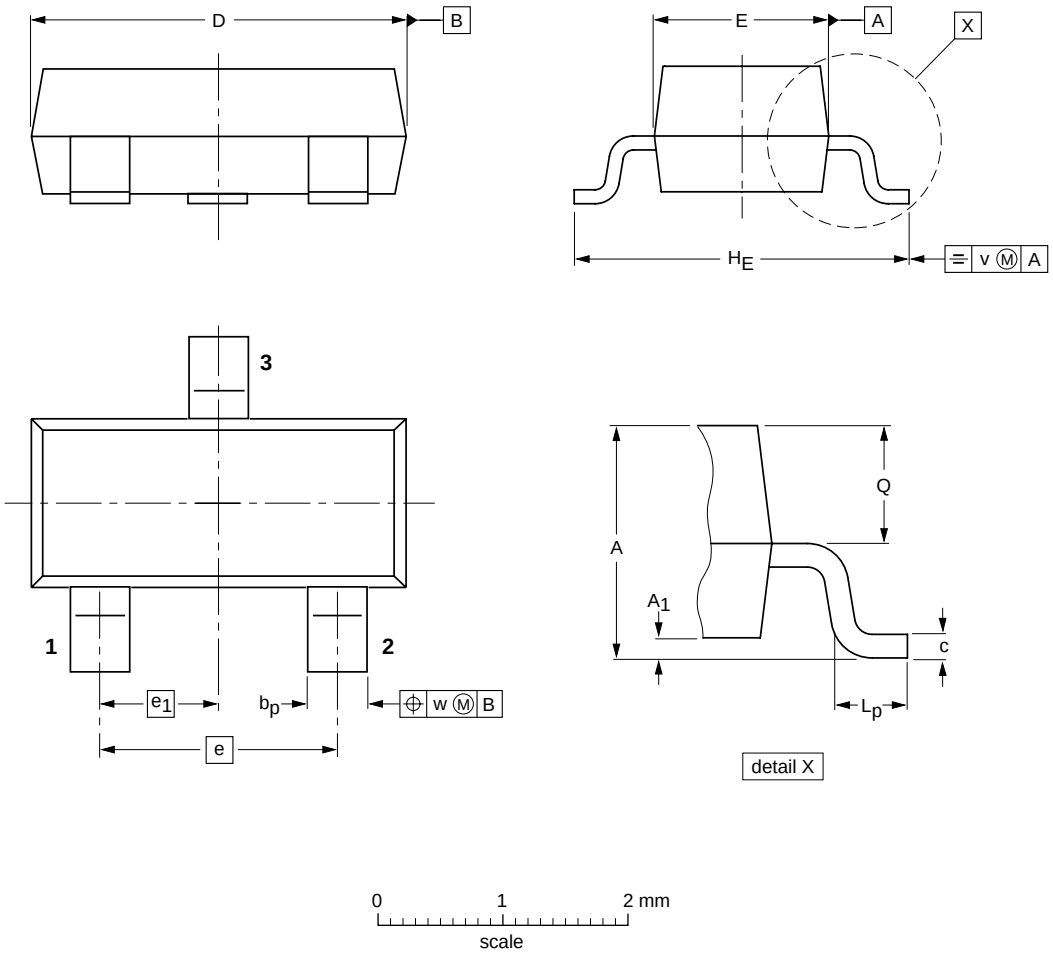


$V_i = 5$ V; T = 500 μs; $t_p = 10$ μs; $t_r = t_f \leq 3$ ns.
R1 = 56 Ω; R2 = 2.5 kΩ; $R_B = 3.9$ kΩ; $R_C = 270$ Ω.
$V_{BB} = 1.9$ V; $V_{CC} = -3$ V.
Oscilloscope: input impedance $Z_i = 50$ Ω.

Fig.7 Test circuit for switching times.

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23		TO-236AB				~~97-02-28~~ 99-09-13