NPN 6 GHz wideband transistor BFP91A

DESCRIPTION

NPN transistor in hermetically-sealed sub-miniature SOT173 and SOT173X micro-stripline envelopes. It features low noise, high gain and low distortion figures and is primarily designed for RF wideband amplifiers and applications up to 1 GHz.

PNP complement is BFQ23C.

PINNING

PIN	DESCRIPTION
Code: P1	
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

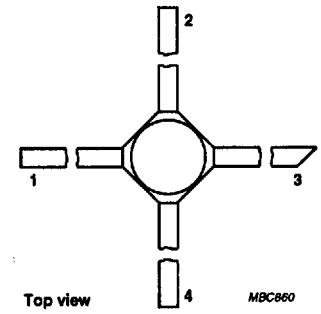

Fig.1 SOT173.

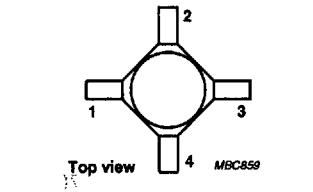

Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	–	600	mW
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	–	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	22.5	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	18.5	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	600	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	22.5	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	18.5	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	1.6	–	dB
		I_C = 30 mA; V_{CE} = 8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

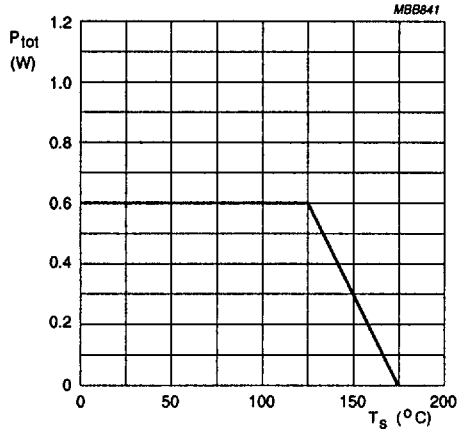
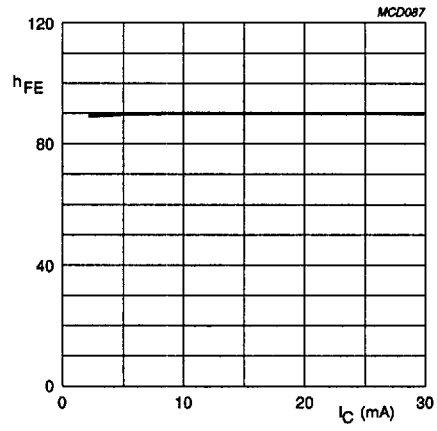
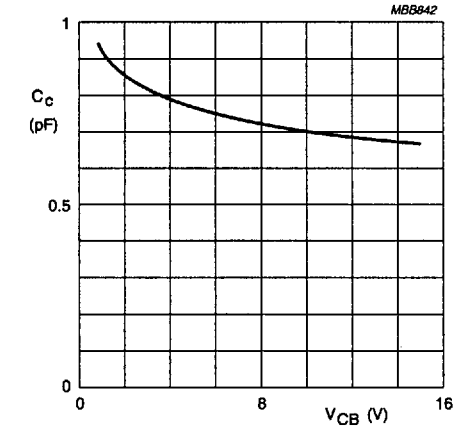


Fig.3 Power derating curve.



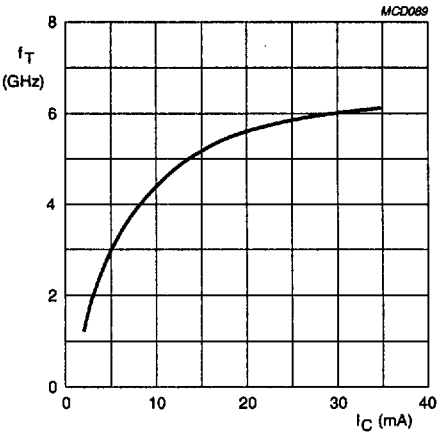
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



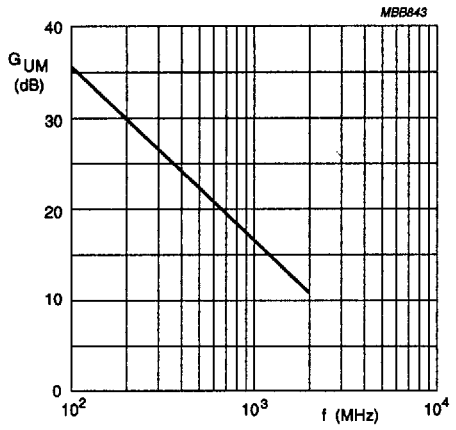
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



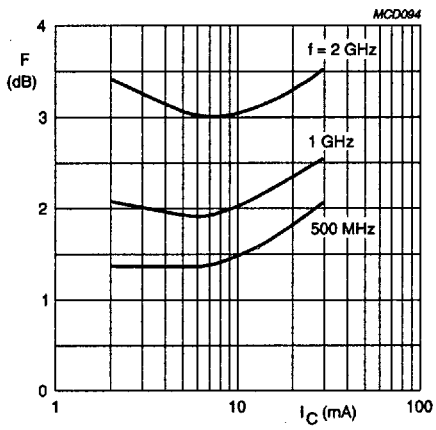
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



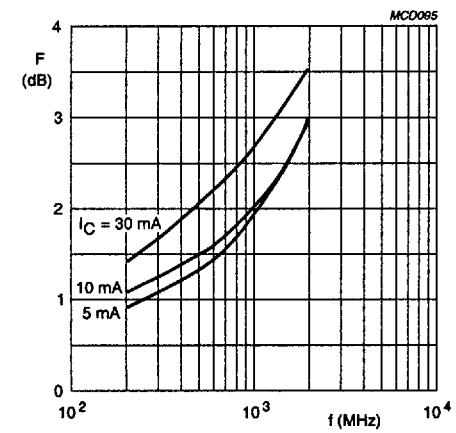
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



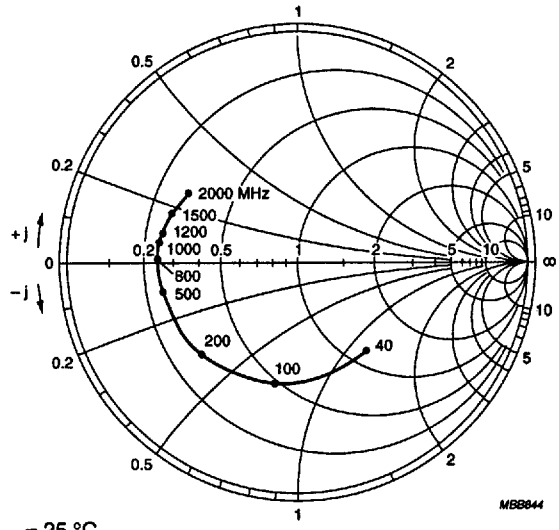
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Minimum noise figure as a function of collector current.



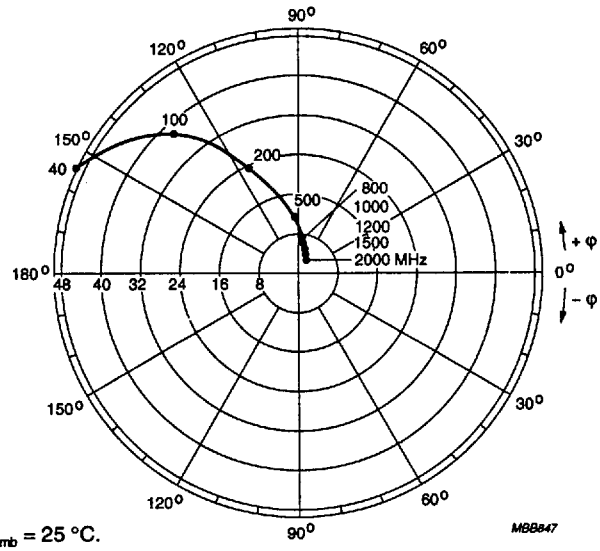
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Minimum noise figure as a function of frequency.



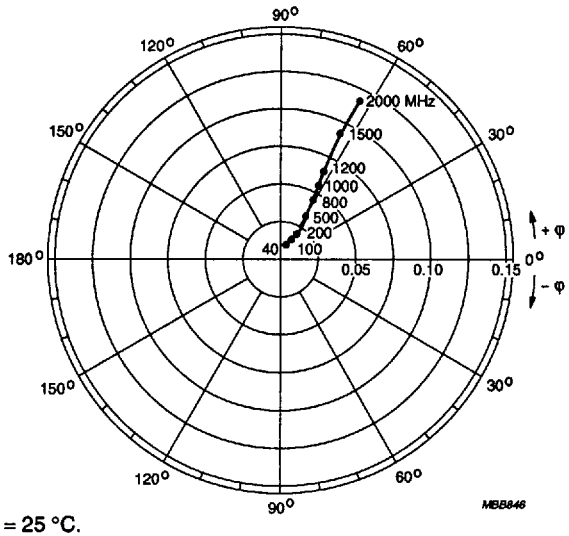
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Common emitter input reflection coefficient (S_{11}).



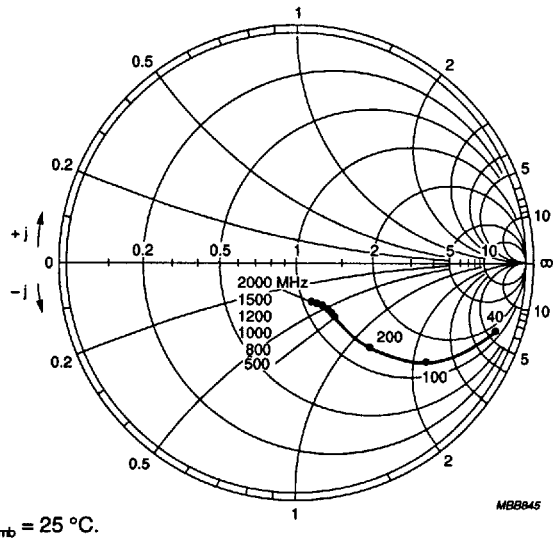
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.12 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.13 Common emitter output reflection coefficient (S_{22}).

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Table 1 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.515	–41.4	39.659	159.9	0.009	82.4	0.931	–16.3	42.0
100	0.535	–87.5	31.553	137.1	0.019	61.0	0.755	–33.9	35.1
200	0.568	–126.3	21.122	117.1	0.025	49.3	0.524	–47.2	29.6
300	0.584	–145.5	15.157	106.4	0.030	47.4	0.398	–51.3	26.2
400	0.590	–156.0	11.706	99.8	0.033	49.0	0.330	–52.3	23.7
500	0.597	–162.9	9.563	95.2	0.038	52.0	0.292	–52.1	21.9
600	0.599	–168.4	8.046	91.4	0.042	55.9	0.266	–51.8	20.4
700	0.600	–172.1	6.960	88.3	0.045	57.2	0.250	–51.6	19.1
800	0.597	–176.1	6.143	85.5	0.050	59.1	0.239	–51.1	17.9
900	0.595	–179.5	5.476	83.1	0.055	59.5	0.230	–51.2	16.9
1000	0.597	177.6	4.958	80.8	0.059	61.4	0.223	–51.5	16.0
1200	0.601	171.9	4.140	76.6	0.068	62.0	0.215	–53.5	14.5
1400	0.603	167.2	3.561	72.7	0.076	63.0	0.209	–56.1	13.2
1600	0.606	163.9	3.148	68.6	0.084	63.8	0.212	–58.1	12.1
1800	0.598	159.8	2.810	65.2	0.096	63.7	0.209	–60.8	11.1
2000	0.601	155.3	2.549	62.0	0.104	64.8	0.201	–63.3	10.3

Table 2 Common emitter scattering parameters, $I_C = 30$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.430	–54.4	47.536	156.5	0.009	76.5	0.903	–19.6	41.8
100	0.496	–104.9	35.535	132.1	0.016	58.1	0.690	–38.7	35.0
200	0.555	–139.1	22.511	113.0	0.022	52.9	0.454	–50.7	29.7
300	0.582	–154.7	15.836	103.3	0.026	53.4	0.341	–53.8	26.3
400	0.591	–163.2	12.137	97.4	0.030	54.0	0.281	–54.1	23.9
500	0.597	–168.4	9.863	93.3	0.034	57.5	0.249	–53.5	22.1
600	0.599	–173.1	8.282	89.8	0.039	62.1	0.227	–52.9	20.5
700	0.598	–176.4	7.154	87.0	0.044	60.8	0.214	–52.3	19.2
800	0.597	–179.6	6.307	84.3	0.048	63.7	0.205	–51.9	18.1
900	0.597	177.4	5.623	82.1	0.053	64.4	0.199	–51.8	17.1
1000	0.598	174.4	5.086	79.9	0.058	66.9	0.192	–52.1	16.2
1200	0.602	169.6	4.245	76.0	0.068	66.2	0.184	–53.8	14.7
1400	0.606	165.0	3.646	72.3	0.077	67.0	0.181	–56.7	13.4
1600	0.609	162.6	3.225	68.3	0.086	66.9	0.184	–58.6	12.3
1800	0.598	158.5	2.877	64.8	0.096	65.7	0.181	–61.3	11.2
2000	0.601	154.3	2.611	62.0	0.105	66.7	0.174	–63.4	10.4

Table 3 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.547	−39.4	39.322	160.0	0.008	84.0	0.933	−15.0	42.3
100	0.549	−84.2	31.404	137.5	0.018	58.4	0.765	−30.9	35.3
200	0.568	−123.8	21.105	117.5	0.024	48.5	0.541	−42.0	29.7
300	0.579	−143.7	15.191	106.7	0.028	47.6	0.423	−44.3	26.3
400	0.581	−154.5	11.742	100.1	0.032	49.7	0.359	−44.3	23.8
500	0.589	−161.5	9.596	95.6	0.037	51.1	0.324	−43.3	22.0
600	0.591	−167.2	8.078	91.8	0.039	54.9	0.301	−42.7	20.4
700	0.592	−171.2	6.992	88.7	0.043	55.1	0.286	−42.3	19.1
800	0.587	−175.2	6.171	85.8	0.047	58.7	0.276	−41.6	18.0
900	0.586	−179.1	5.504	83.4	0.052	58.9	0.268	−41.5	17.0
1000	0.587	177.8	4.975	81.1	0.055	60.8	0.261	−41.5	16.1
1200	0.594	172.2	4.152	77.0	0.065	62.3	0.253	−43.2	14.5
1400	0.596	167.8	3.577	73.1	0.072	62.7	0.248	−45.3	13.3
1600	0.595	164.5	3.156	68.9	0.080	63.7	0.248	−47.3	12.2
1800	0.586	159.8	2.817	65.5	0.090	63.0	0.246	−49.7	11.1
2000	0.588	155.7	2.556	62.3	0.097	64.5	0.235	−51.6	10.2

Table 4 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.475	−48.9	47.699	157.1	0.008	83.2	0.910	−18.1	42.3
100	0.507	−97.9	36.132	133.1	0.016	60.1	0.707	−35.9	35.4
200	0.545	−134.2	23.140	113.8	0.022	52.8	0.476	−46.7	29.9
300	0.568	−151.6	16.353	104.0	0.025	52.4	0.364	−48.9	26.6
400	0.574	−160.6	12.551	97.9	0.029	53.3	0.305	−48.5	24.1
500	0.580	−166.3	10.211	93.8	0.033	56.7	0.274	−47.6	22.3
600	0.582	−171.1	8.574	90.3	0.038	60.8	0.254	−46.5	20.8
700	0.584	−174.8	7.407	87.4	0.041	62.0	0.240	−46.3	19.5
800	0.578	−178.0	6.532	84.8	0.047	63.4	0.232	−45.5	18.3
900	0.580	178.8	5.822	82.4	0.052	64.1	0.226	−45.5	17.3
1000	0.584	175.8	5.263	80.3	0.057	66.1	0.221	−45.6	16.4
1200	0.587	170.4	4.393	76.4	0.065	65.8	0.213	−47.4	14.9
1400	0.586	166.3	3.775	72.7	0.074	67.1	0.210	−49.7	13.6
1600	0.588	163.1	3.335	68.7	0.083	66.6	0.212	−51.6	12.5
1800	0.580	159.6	2.974	65.4	0.093	66.3	0.210	−54.4	11.4
2000	0.585	154.4	2.700	62.3	0.102	66.7	0.202	−56.7	10.6