

NPN 2 GHz wideband transistor



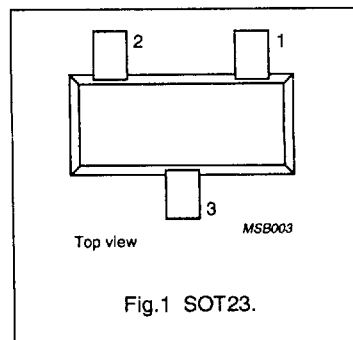
DESCRIPTION

NPN transistor in a plastic SOT23 envelope.

It is primarily intended for use in RF low power amplifiers, such as in pocket phones, paging systems, etc. The transistor features low current consumption (100 μ A to 1 mA); due to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PINNING

PIN	DESCRIPTION
Code: V1p	
1	base
2	emitter
3	collector



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	8	V
V_{CEO}	collector-emitter voltage	open base	—	5	V
I_C	DC collector current		—	6.5	mA
P_{tot}	total power dissipation	up to $T_s = 142^\circ\text{C}$ (note 1)	—	30	mW
f_T	transition frequency	$I_C = 1\text{ mA}$; $V_{CE} = 1\text{ V}$; $f = 500\text{ MHz}$; $T_j = 25^\circ\text{C}$	2.3	—	GHz
C_{re}	feedback capacitance	$I_C = 1\text{ mA}$; $V_{CE} = 1\text{ V}$; $f = 1\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	—	0.45	pF
G_{UM}	maximum unilateral power gain	$I_C = 1\text{ mA}$; $V_{CE} = 1\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	18	—	dB
F	noise figure	$I_C = 1\text{ mA}$; $V_{CE} = 1\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	3.8	—	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	8	V
V_{CEO}	collector-emitter voltage	open base	—	5	V
V_{EBO}	emitter-base voltage	open collector	—	2	V
I_C	DC collector current		—	6.5	mA
I_{CM}	peak collector current	$f > 1\text{ MHz}$	—	10	mA
P_{tot}	total power dissipation	up to $T_s = 142^\circ\text{C}$ (note 1)	—	30	mW
T_{slg}	storage temperature		−65	150	$^\circ\text{C}$
T_j	junction temperature		—	150	$^\circ\text{C}$

Note

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

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THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-a}$	thermal resistance from junction to soldering point	up to $T_s = 142\text{ °C}$ (note 1)	260 K/W

Note

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

CHARACTERISTICS

$T_j = 25\text{ °C}$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0; V_{CB} = 5\text{ V}$	—	—	50	nA
h_{FE}	DC current gain	$I_C = 10\text{ }\mu\text{A}; V_{CE} = 1\text{ V}$	20	30	—	
		$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}$	20	40	—	
f_T	transition frequency	$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}; f = 500\text{ MHz}$	1.2	2.3	—	GHz
C_c	collector capacitance	$I_E = I_B = 0; V_{CB} = 0.5\text{ V}; f = 1\text{ MHz}$	—	—	0.6	pF
C_e	emitter capacitance	$I_C = I_E = 0; V_{EB} = 0; f = 1\text{ MHz}$	—	—	0.5	pF
C_{re}	feedback capacitance	$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}; f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$	—	—	0.45	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	—	18	—	dB
		$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ °C}$	—	12	—	dB
F	noise figure	$I_C = 0.1\text{ mA}; V_{CE} = 1\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	—	5.5	—	dB
		$I_C = 1\text{ mA}; V_{CE} = 1\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	—	3.8	—	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.

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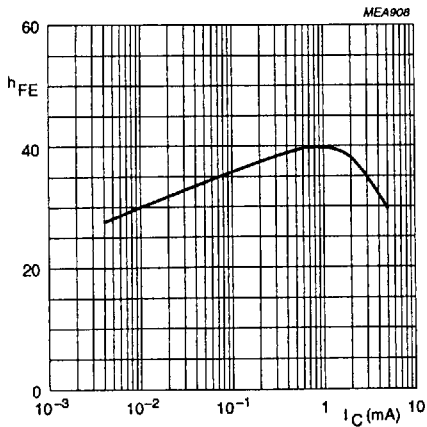

 $V_{CE} = 1 \text{ V}; T_j = 25^\circ\text{C}.$

Fig.2 DC current gain as a function of collector current.

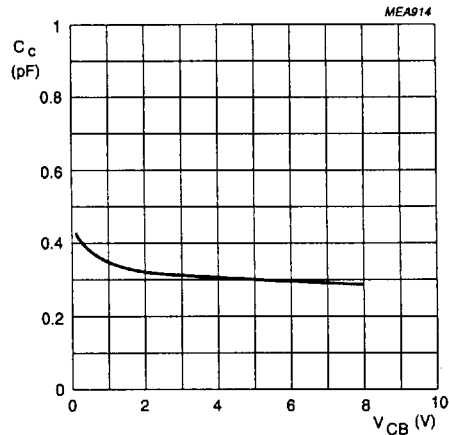

 $I_E = I_B = 0; f = 1 \text{ MHz}; T_j = 25^\circ\text{C}.$

Fig.3 Collector capacitance as a function of collector-base voltage.

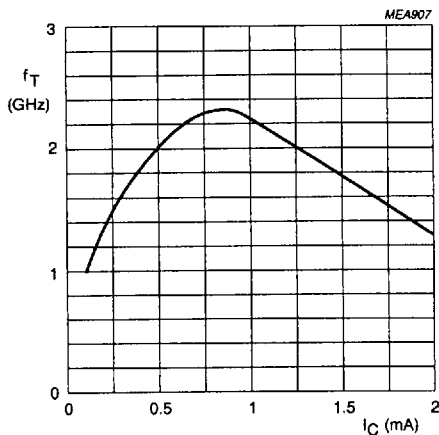

 $V_{CE} = 1 \text{ V}; f = 500 \text{ MHz}; T_j = 25^\circ\text{C}.$

Fig.4 Transition frequency as a function of collector current.

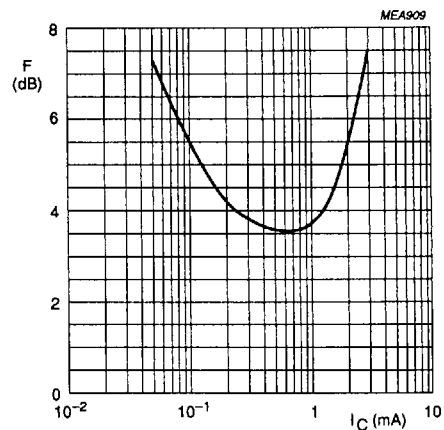
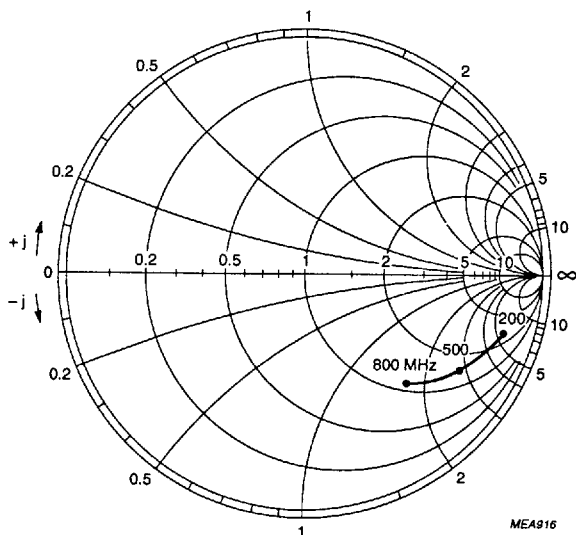
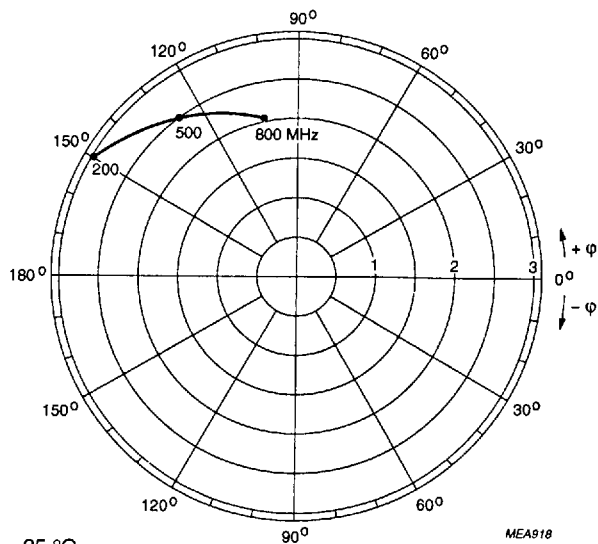

 $V_{CE} = 1 \text{ V}; Z_S = \text{opt.}; f = 500 \text{ MHz}; T_{\text{amb}} = 25^\circ\text{C}.$

Fig.5 Minimum noise figure as a function of collector current.

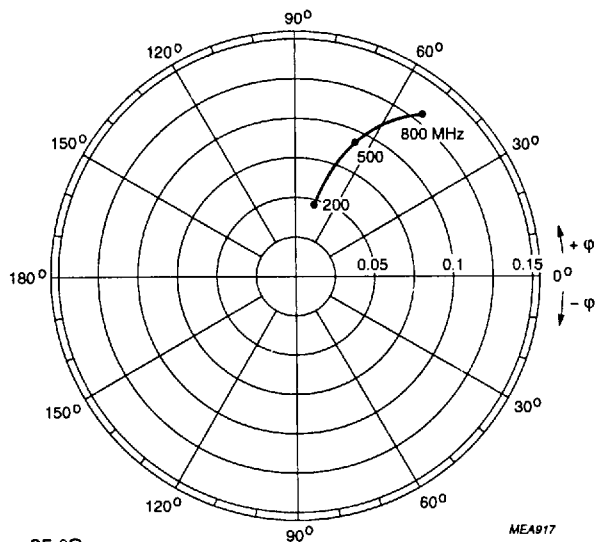
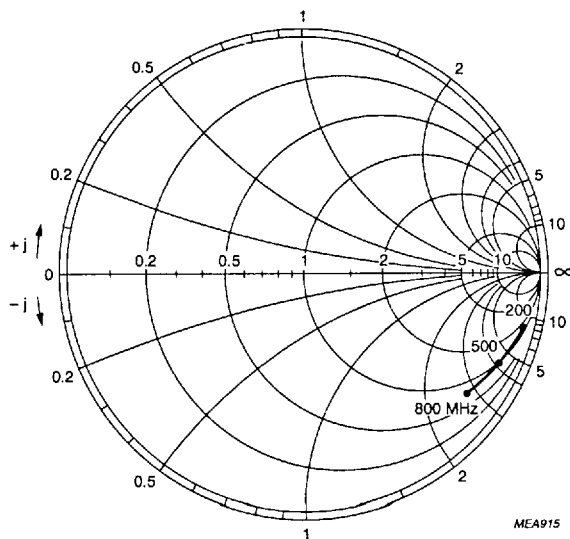
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 $I_C = 1 \text{ mA}$; $V_{CE} = 1 \text{ V}$; $T_{amb} = 25^\circ \text{C}$.Fig.6 Common emitter input reflection coefficient (S_{11}). $I_C = 1 \text{ mA}$; $V_{CE} = 1 \text{ V}$; $T_{amb} = 25^\circ \text{C}$.Fig.7 Common emitter forward transmission coefficient (S_{21}).

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 $I_C = 1 \text{ mA}; V_{CE} = 1 \text{ V}; T_{amb} = 25^\circ\text{C}.$
Fig.8 Common emitter reverse transmission coefficient (S_{12}).
 $I_C = 1 \text{ mA}; V_{CE} = 1 \text{ V}; T_{amb} = 25^\circ\text{C}.$
Fig.9 Common emitter output reflection coefficient (S_{22}).

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Table 1 Common emitter scattering parameters, $I_C = 1$ mA; $V_{CE} = 1$ 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	0.948	-2.8	3.158	176.0	0.008	83.6	0.998	-1.7	43.9
100	0.935	-7.2	3.098	168.9	0.023	84.2	0.993	-4.4	37.4
200	0.913	-13.0	3.061	160.5	0.045	80.5	0.972	-8.6	30.1
300	0.881	-19.7	2.917	151.2	0.066	76.6	0.952	-12.6	26.1
400	0.849	-24.9	2.753	143.5	0.085	74.1	0.930	-16.1	23.0
500	0.797	-30.4	2.722	135.8	0.102	71.9	0.899	-19.0	20.2
600	0.747	-34.0	2.526	129.3	0.118	69.3	0.878	-21.7	18.0
700	0.717	-36.3	2.364	123.6	0.132	68.0	0.848	-23.8	16.1
800	0.663	-40.7	2.237	116.7	0.145	65.7	0.829	-25.7	14.6
900	0.638	-43.0	2.112	112.1	0.156	64.7	0.814	-27.2	13.5
1000	0.584	-44.7	1.993	106.1	0.168	63.4	0.791	-28.8	12.1
1200	0.523	-49.3	1.797	97.1	0.189	61.3	0.756	-31.4	10.2
1400	0.463	-54.4	1.677	90.0	0.211	59.6	0.726	-34.1	8.8
1600	0.438	-53.3	1.548	84.9	0.230	58.4	0.707	-36.0	7.7
1800	0.396	-52.8	1.383	78.0	0.244	57.0	0.690	-37.8	6.4
2000	0.364	-56.7	1.351	72.8	0.262	55.7	0.671	-39.7	5.8
2200	0.295	-54.3	1.245	66.6	0.279	54.2	0.639	-41.7	4.6
2400	0.286	-57.4	1.222	62.5	0.301	52.5	0.615	-44.9	4.2
2600	0.263	-61.3	1.175	59.5	0.315	51.3	0.604	-47.8	3.7
2800	0.268	-60.1	1.120	56.6	0.332	50.6	0.597	-49.9	3.2
3000	0.238	-58.1	1.079	52.2	0.346	48.8	0.577	-51.3	2.7