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NPN Silicon RF Broadband Transistor

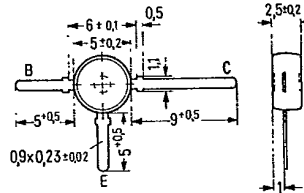
BFT 12

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BFT 12 is an epitaxial NPN silicon planar RF transistor in a plastic package similar to TO 119 (50 B 3 DIN 41 867), intended for universal application in amplifiers up to the GHz range, e. g. for broadband antenna amplifiers with a high output power and linearity and for oscillators.

Type	Ordering code
BFT 12	Q62702-F390



Approx. weight 0.3 g Dimensions in mm

**Maximum ratings**

Collector-base-voltage	$V_{CBO}$	25	V
Collector-emitter voltage	$V_{CEO}$	15	V
Emitter-base voltage	$V_{EBO}$	3.5	V
Collector current	$I_C$	150	mA
Collector peak current ( $f > 1$ MHz)	$I_{CM}$	300	mA
Base current	$I_B$	50	mA
Junction temperature	$T_j$	150	°C
Storage temperature range	$T_{stg}$	-55 to +125	°C
Total power dissipation ( $T_{amb} = 66$ °C)	$P_{tot}$	700	mW

**Thermal resistance**

Junction to ambient air <sup>1)</sup>	$R_{thJA}$	≤ 120	K/W
Junction to case	$R_{thJC}$	≤ 90	K/W

1) when mounted on glass fiber epoxy resin PCB 40 mm x 25 mm x 1 mm

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Static characteristics ( $T_{amb} = 25^{\circ}\text{C}$ )

Collector-base breakdown voltage ( $I_{CBO} = 100 \mu\text{A}$ )	$V_{(BR)CBO}$	> 25	V
DC current gain ( $I_C = 50 \text{ mA}; V_{CE} = 5 \text{ V}$ )	$h_{FE}$	$\geq 25$	-

Dynamic characteristics ( $T_{amb} = 25^{\circ}\text{C}$ )

Transition frequency ( $I_C = 80 \text{ mA}; V_{CE} = 5 \text{ V}; f = 200 \text{ MHz}$ )	$f_T$	1.9	GHz
Reverse transfer capacitance ( $I_C = 5 \text{ mA}; V_{CE} = 10 \text{ V}; f = 1 \text{ MHz}$ )	$C_{12e}$	2.4	pF
Collector-base capacitance ( $V_{CBO} = 10 \text{ V}; f = 1 \text{ MHz}$ )	$C_{CBO}$	3	pF
Power gain ( $I_C = 40 \text{ mA}; V_{CE} = 7.5 \text{ V}; f = 800 \text{ MHz}; R_g = 60 \Omega$ )	$G_{pe}$	7.5	dB
( $I_C = 80 \text{ mA}; V_{CE} = 7.5 \text{ V}; f = 800 \text{ MHz}; R_g = 60 \Omega$ )	$G_{pe}$	8	dB
Noise figure ( $R_g = 60 \Omega; I_C = 40 \text{ mA}; V_{CE} = 7.5 \text{ V}; f = 800 \text{ MHz}$ )	$NF$	6.5	dB
Output voltage <sup>1)</sup> ( $I_C = 80 \text{ mA}; V_{CE} = 7.5 \text{ V}; f = 800 \text{ MHz}; d_{IM} = 60 \text{ dB}, R_g = R_L = 75 \Omega$ )	$V_0$	1000	mV

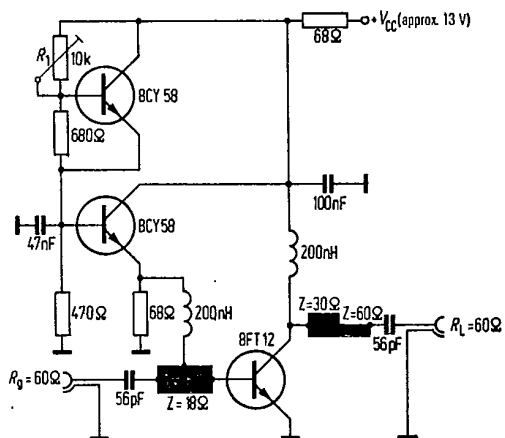
S parameter at  $V_{CE} = 7.5 \text{ V}; I_C = 60 \text{ mA}; Z_o = 50 \Omega$

f (GHz)	$S_{11e}$	$\varphi$	$S_{21e}$	$\varphi$	$S_{12e}$	$\varphi$	$S_{22e}$	$\varphi$
0,1	0,691	-170	14,199	94	0,022	55	0,208	-115
0,2	0,701	-177	7,261	85	0,038	68	0,160	-135
0,3	0,717	177	4,860	78	0,053	70	0,151	-147
0,4	0,722	175	3,666	73	0,069	71	0,159	-148
0,5	0,715	173	2,909	67	0,083	72	0,168	-149
0,6	0,726	169	2,458	63	0,101	73	0,179	-148
0,7	0,738	167	2,102	59	0,115	72	0,192	-149
0,8	0,736	165	1,823	53	0,130	72	0,214	-149
0,9	0,740	163	1,619	49	0,146	71	0,240	-147
1	0,752	161	1,458	44	0,159	70	0,244	-148

1) three tone modulation f approx. 800 MHz

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Circuit example: Broadband RF amplifier



Operating point (set with  $R_1$ ):  
 $I_C = 80 \text{ mA}$ ;  $V_{CE} = 7.5 \text{ V}$ .

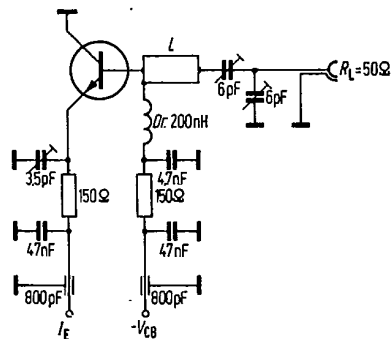
At  $f = 800 \text{ MHz}$  and an intermodulation product distance of  $d_{IM} = 60 \text{ dB}^1$ , the following values are obtained:

Output voltage  $V_O = 700 \text{ mV}$   
 Power gain  $G_P = 8 \text{ dB}$   
 (refer to curve  $G_P = f(f)$ )

1) Two-tone modulation  $f_1 = 800 \text{ MHz}$ ;  $f_2 = 804 \text{ MHz}$ .

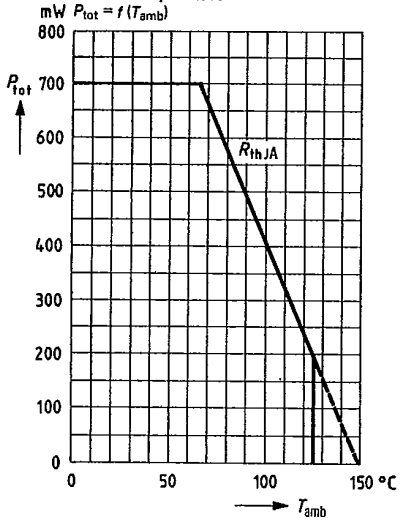
Oscillator diagram

$f = 1 \text{ GHz}$ ;  $L = 15 \text{ mm strip-line}$   
 $Z_0 = 50 \Omega$

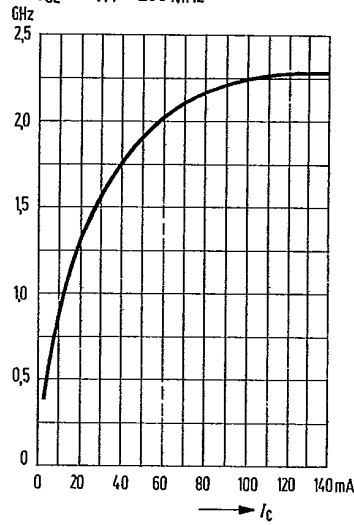


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Total perm. power dissipation versus temperature

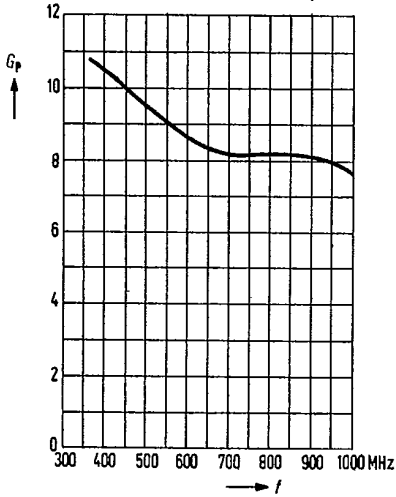


Transition frequency  $f_T = f(I_C)$



Power gain  $G_p = f(f)$

$I_C = 80\text{ mA}; V_{CE} = 7.5\text{ V}$   
 dB TV band IV-V (refer to circuit example)



Oscillator output power

$P_{osc} = f(V_{CB}); I_C = 75\text{ mA}; f = 1\text{ GHz}$

