

BFR91

CASE 317A-01, STYLE 2 HIGH FREQUENCY TRANSISTOR

NPN SILICON



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	12	Vdc
Collector-Base Voltage	V_{CBO}	15	Vdc
Emitter-Base Voltage	V_{EBO}	3.0	Vdc
Collector Current — Continuous	I_C	35	mA _{dc}
Total Device Dissipation @ $T_A = 60^\circ\text{C}$ Derate above 60°C	P_D	180 2.0	mW mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	500	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ($I_C = 1.0$ mA _{dc} , $I_B = 0$)	$V_{(BR)CEO}$	12	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 0.1$ mA _{dc} , $I_E = 0$)	$V_{(BR)CBO}$	15	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 0.1$ mA _{dc} , $I_C = 0$)	$V_{(BR)EBO}$	3.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 5.0$ Vdc, $I_E = 0$)	I_{CBO}	—	—	50	nA _{dc}

ON CHARACTERISTICS

DC Current Gain ($I_C = 30$ mA _{dc} , $V_{CE} = 5.0$ Vdc)	h_{FE}	25	—	250	—
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SMALL SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product ($I_C = 30$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 0.5$ GHz)	f_T	—	5.0	—	GHz
Collector-Base Capacitance ($V_{CB} = 10$ Vdc, $I_E = 0$, $f = 1.0$ MHz)	C_{cb}	—	0.7	1.0	pF

FUNCTIONAL TEST

Noise Figure ($I_C = 2.0$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 0.5$ GHz) ($I_C = 2.0$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 1.0$ GHz)	NF	— —	1.9 2.5	— —	dB
Power Gain at Optimum Noise Figure ($I_C = 2.0$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 0.5$ GHz) ($I_C = 2.0$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 1.0$ GHz)	G _{NF}	— —	11 8.0	— —	dB
Maximum Available Power(1) ($I_C = 30$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 0.5$ GHz) ($I_C = 30$ mA _{dc} , $V_{CE} = 5.0$ Vdc, $f = 1.0$ GHz)	G _{max}	— —	16 10	— —	dB

$$(1) G_{max} = \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$$

FIGURE 1 – POWER DERATING

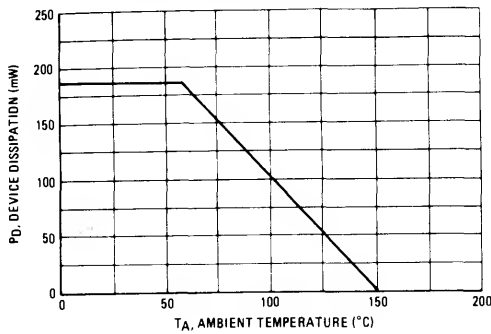


FIGURE 2 - POWER GAIN AND NOISE
FIGURE versus FREQUENCY

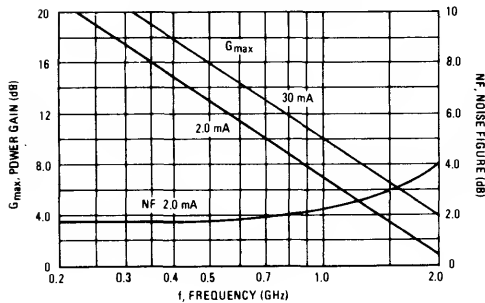


FIGURE 3 - POWER GAIN AND NOISE
FIGURE versus COLLECTOR CURRENT

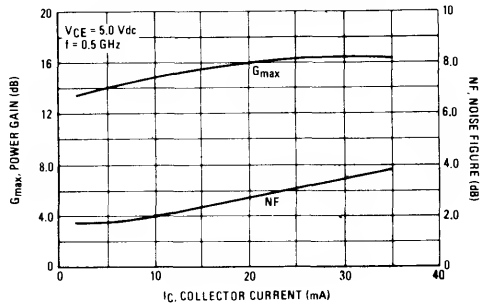


FIGURE 4 – S₁₁ PARAMETERS

Frequency (MHz)		200		500		800		1000		1500	
VCE (Volts)	I _C (mA)	S ₁₁	∠φ	S ₁₁	∠φ	S ₁₁	∠φ	S ₁₁	∠φ	S ₁₁	∠φ
5.0	2.0	0.72	-65	0.51	-125	0.46	-165	0.47	170	0.51	145
	5.0	0.49	-90	0.35	-150	0.34	175	0.36	155	0.41	135
	10	0.34	-110	0.28	-165	0.29	165	0.32	145	0.36	130
	20	0.26	-130	0.24	180	0.27	155	0.30	140	0.34	125
	30	0.24	-145	0.24	175	0.27	155	0.30	140	0.34	125
10	2.0	0.74	-60	0.51	-120	0.45	-160	0.45	170	0.49	150
	5.0	0.52	-80	0.33	-140	0.31	-175	0.32	160	0.37	145
	10	0.36	-95	0.24	-155	0.24	170	0.27	155	0.31	140
	20	0.25	-115	0.19	-170	0.21	160	0.24	145	0.29	130
	30	0.22	-120	0.19	-175	0.21	160	0.25	145	0.20	130

FIGURE 5 – S₂₂ PARAMETERS

Frequency (MHz)		200		500		800		1000		1500	
VCE (Volts)	I _C (mA)	S ₂₂	∠φ	S ₂₂	∠φ	S ₂₂	∠φ	S ₂₂	∠φ	S ₂₂	∠φ
5.0	2.0	0.83	-25	0.62	-35	0.55	-40	0.51	-45	0.49	-60
	5.0	0.66	-30	0.45	-35	0.40	-40	0.37	-40	0.34	-50
	10	0.52	-35	0.36	-35	0.32	-35	0.30	-35	0.27	-50
	20	0.42	-35	0.30	-30	0.27	-30	0.26	-30	0.22	-45
	30	0.38	-35	0.28	-25	0.26	-30	0.25	-30	0.21	-40
10	2.0	0.86	-20	0.67	-30	0.62	-35	0.58	-40	0.56	-50
	5.0	0.71	-25	0.53	-30	0.48	-30	0.45	-35	0.43	-45
	10	0.59	-30	0.45	-25	0.41	-30	0.40	-30	0.37	-40
	20	0.50	-25	0.40	-25	0.38	-25	0.37	-30	0.34	-40
	30	0.47	-25	0.40	-20	0.38	-25	0.37	-30	0.34	-35

FIGURE 6 – S₂₁ PARAMETERS

Frequency (MHz)		200		500		800		1000		1500	
V _{CE} (Volts)	I _C (mA)	S ₂₁	∠ ϕ	S ₂₁	∠ ϕ	S ₂₁	∠ ϕ	S ₂₁	∠ ϕ	S ₂₁	∠ ϕ
5.0	2.0	5.25	130	3.06	95	2.10	75	1.70	65	1.20	50
	5.0	8.72	120	4.34	90	2.84	75	2.30	65	1.60	50
	10	10.85	110	4.92	85	3.22	70	2.60	65	1.80	50
	20	12.13	105	5.34	80	3.44	70	2.75	60	1.90	50
	30	12.50	100	5.42	80	3.47	70	2.75	60	1.90	50
10	2.0	5.36	135	3.20	95	2.20	80	1.85	65	1.30	50
	5.0	9.05	120	4.55	90	3.00	75	2.45	65	1.65	50
	10	11.37	110	5.22	85	3.40	75	2.65	65	1.85	50
	20	12.83	105	5.64	80	3.63	70	2.75	60	2.00	50
	30	13.10	100	5.62	80	3.63	70	2.75	60	2.00	50

FIGURE 7 – S₁₂ PARAMETERS

Frequency (MHz)		200		500		800		1000		1500	
V _{CE} (Volts)	I _C (mA)	S ₁₂	∠ ϕ	S ₁₂	∠ ϕ	S ₁₂	∠ ϕ	S ₁₂	∠ ϕ	S ₁₂	∠ ϕ
5.0	2.0	0.08	55	0.11	45	0.12	50	0.14	55	0.17	65
	5.0	0.06	55	0.09	60	0.13	65	0.17	65	0.22	65
	10	0.05	60	0.09	65	0.14	70	0.19	65	0.24	65
	20	0.05	70	0.07	70	0.15	70	0.19	70	0.25	65
	30	0.04	75	0.10	75	0.15	70	0.19	70	0.25	65
10	2.0	0.06	60	0.09	45	0.10	50	0.12	60	0.15	70
	5.0	0.05	60	0.08	60	0.11	65	0.15	65	0.19	70
	10	0.05	65	0.08	65	0.12	70	0.16	70	0.21	70
	20	0.04	70	0.08	70	0.13	70	0.17	70	0.22	70
	30	0.04	70	0.08	75	0.13	70	0.17	70	0.22	70