

# The RF Line NPN Silicon High-Frequency Transistor

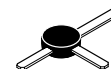
The BFR96 transistor uses the same state-of-the-art microwave transistor chip which features fine-line geometry, ion-implanted arsenic emitters and gold top metallization. This transistor is intended for low-to-medium power amplifiers requiring high gain, low noise figure, and low intermodulation distortion. The BFR96 is particularly suitable for broadband MATV/CATV amplifiers.

**BFR96**

$f_T = 4.5 \text{ GHz @ } 50 \text{ mA}$   
HIGH-FREQUENCY  
TRANSISTOR  
NPN SILICON

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	15	Vdc
Collector-Base Voltage	$V_{CBO}$	20	Vdc
Emitter-Base Voltage	$V_{EBO}$	3.0	Vdc
Collector Current — Continuous	$I_C$	100	mAdc
Total Device Dissipation @ $T_C = 100^\circ\text{C}$ (1) Derate above $T_C = 100^\circ\text{C}$	$P_D$	0.5 10	Watts mW/°C
Storage Temperature	$T_{stg}$	-65 to +150	°C



CASE 317A-01, STYLE 2

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C = 1.0 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	15	—	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	20	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 100 \mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	3.0	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	—	100	nAdc

### ON CHARACTERISTICS

DC Current Gain ( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	$h_{FE}$	30	—	200	—
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### DYNAMIC CHARACTERISTICS

Current-Gain — Bandwidth Product ( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 0.5 \text{ GHz}$ )	$f_T$	—	4.5	—	GHz
Collector-Base Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , Emitter Guarded)	$C_{cb}$	—	1.2	1.5	pF

NOTE:

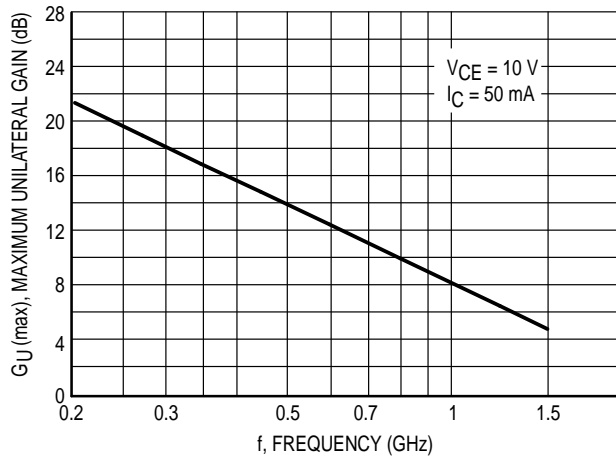
- Case temperature measured on collector lead immediately adjacent to body of package.

(continued)

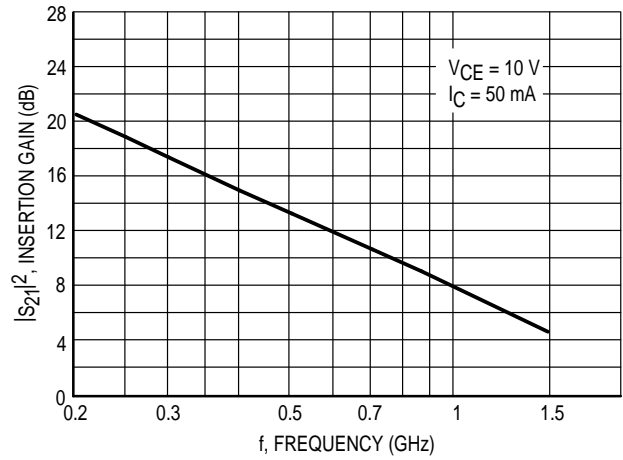
**ELECTRICAL CHARACTERISTICS — continued** ( $T_C = 25^\circ\text{C}$  unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>FUNCTIONAL TESTS</b>					
Noise Figure ( $I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 0.5\text{ GHz}$ )	NF	—	2.0	—	dB
Maximum Unilateral Gain/Insertion Gain (2) ( $I_C = 50\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 0.5\text{ GHz}$ )	$G_{U(\text{max})}/ S_{21} ^2$	—/12	14.5/13	—	dB

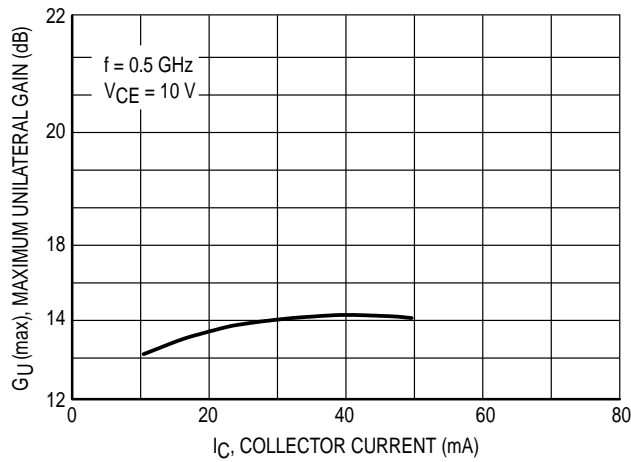
NOTE: 2.  $G_{U(\text{max})} = \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$



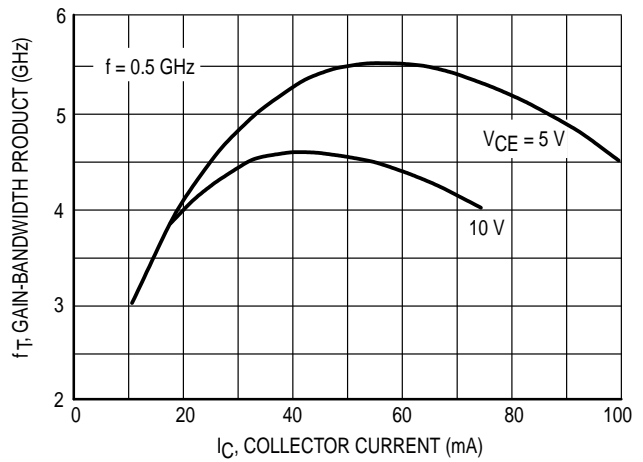
**Figure 1. Maximum Unilateral Gain versus Frequency**



**Figure 2.  $|S_{21}|^2$  versus Frequency**



**Figure 3. Maximum Unilateral Gain versus Collector Current**



**Figure 4. Gain-Bandwidth Product versus Collector Current**

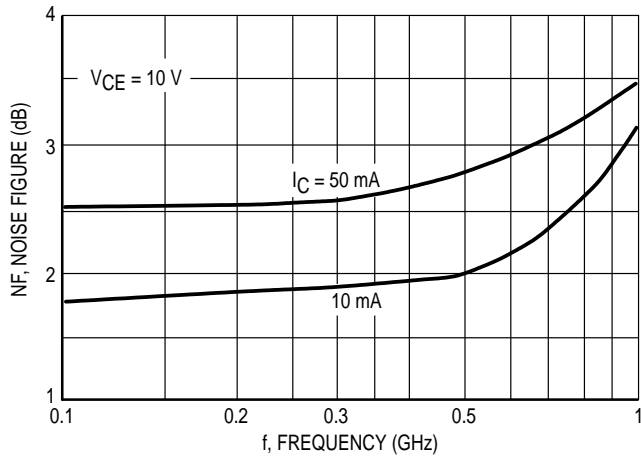


Figure 5. Noise Figure versus Frequency

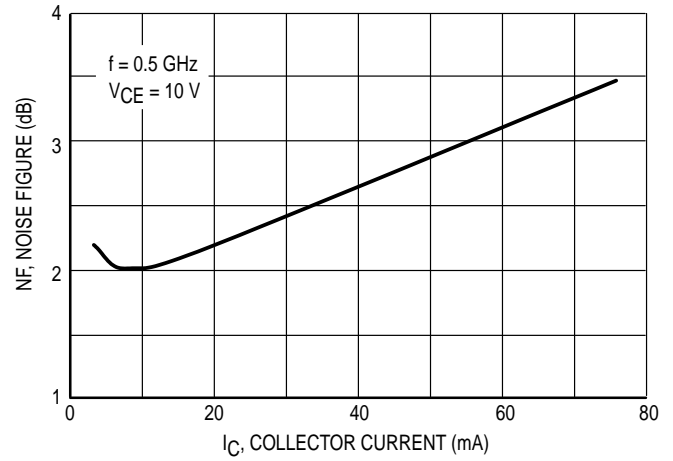


Figure 6. Noise Figure versus Collector Current

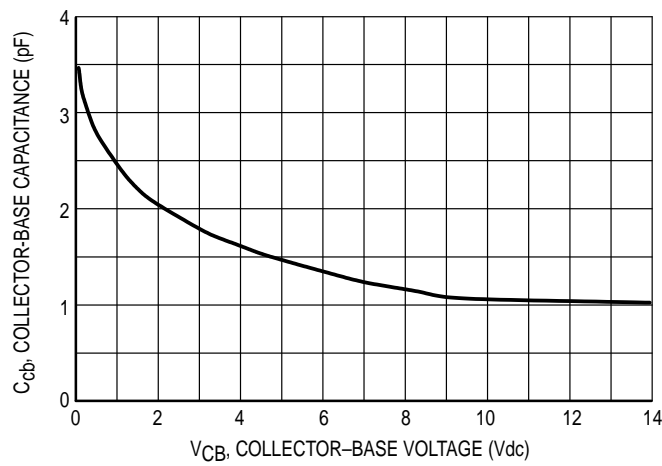
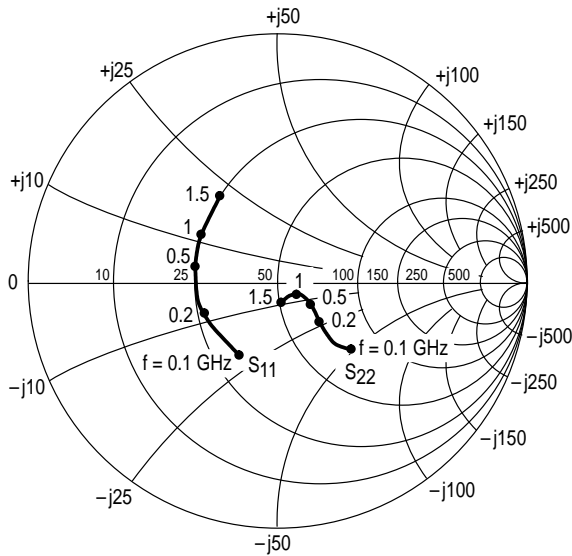
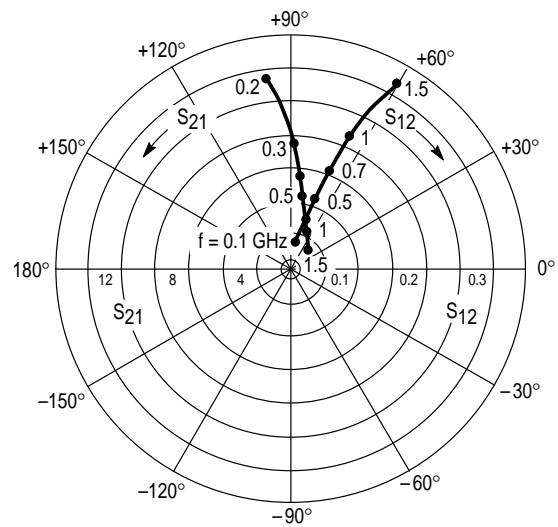


Figure 7. Collector-Base Capacitance versus Collector-Base Voltage



**Figure 8. Input/Output Reflection Coefficients versus Frequency**  
( $V_{CE} = 10\text{ V}$ ,  $I_C = 50\text{ mA}$ )

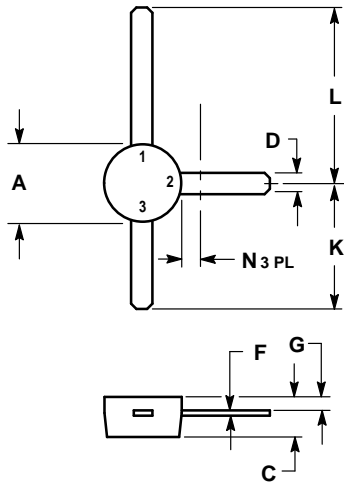


**Figure 9. Forward/Reverse Transmission Coefficients versus Frequency**  
( $V_{CE} = 10\text{ V}$ ,  $I_C = 50\text{ mA}$ )

$V_{CE}$ (Volts)	$I_C$ (mA)	f (MHz)	$S_{11}$		$S_{21}$		$S_{12}$		$S_{22}$	
			$ S_{11} $	$\phi$	$ S_{21} $	$\phi$	$ S_{12} $	$\phi$	$ S_{22} $	$\phi$
5.0	10	100	0.51	-95	15.04	121	0.047	54	0.58	-48
		300	0.43	-163	5.87	92	0.082	58	0.26	-63
		500	0.46	174	3.61	79	0.120	63	0.19	-63
		700	0.48	162	2.65	68	0.161	63	0.15	-64
		1000	0.48	146	1.92	57	0.220	63	0.12	-79
		1500	0.54	121	1.40	43	0.320	58	0.13	-118
	25	100	0.39	-122	19.41	112	0.037	60	0.42	-68
		300	0.39	-176	6.81	89	0.079	68	0.16	-94
		500	0.42	166	4.11	78	0.129	70	0.10	-103
		700	0.44	156	3.05	69	0.176	68	0.06	-119
		1000	0.44	142	2.20	59	0.244	64	0.06	-159
		1500	0.49	118	1.62	45	0.348	57	0.10	177
	50	100	0.35	-140	21.10	106	0.032	64	0.33	-81
		300	0.38	176	7.11	88	0.081	72	0.13	-116
		500	0.42	162	4.28	78	0.133	72	0.09	-136
		700	0.43	153	3.16	70	0.183	69	0.07	-163
		1000	0.42	140	2.28	60	0.252	65	0.08	165
		1500	0.47	116	1.66	47	0.357	57	0.12	155
10	10	100	0.53	-83	15.96	124	0.039	58	0.65	-36
		300	0.38	-154	6.44	94	0.070	59	0.35	-41
		500	0.41	-179	3.98	81	0.102	64	0.30	-39
		700	0.42	166	2.94	70	0.138	65	0.27	-39
		1000	0.42	151	2.12	60	0.191	66	0.24	-47
		1500	0.49	125	1.50	44	0.278	63	0.22	-72
	25	100	0.38	-104	20.85	115	0.032	60	0.48	-48
		300	0.32	-169	7.54	91	0.070	68	0.23	-48
		500	0.35	170	4.61	80	0.109	71	0.19	-43
		700	0.37	160	3.37	70	0.152	69	0.16	-39
		1000	0.37	146	2.43	61	0.210	67	0.13	-44
		1500	0.43	121	1.73	47	0.304	61	0.10	-74
	50	100	0.33	-119	22.59	109	0.029	63	0.39	-51
		300	0.30	-176	7.74	88	0.069	72	0.19	-47
		500	0.34	166	4.70	79	0.113	73	0.16	-40
		700	0.36	158	3.45	70	0.156	70	0.14	-35
		1000	0.36	144	2.46	61	0.217	66	0.11	-39
		1500	0.42	119	1.75	47	0.310	60	0.08	-72

**Table 1. Common-Emitter S-Parameters**

# PACKAGE DIMENSIONS




NOTES:  
1. DIMENSION D NOT APPLICABLE IN ZONE N.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.76	1.14	0.030	0.045
K	7.24	8.13	0.285	0.320
L	10.54	11.43	0.415	0.450
N	—	1.65	—	0.065

STYLE 2:  
PIN 1. COLLECTOR  
2. EMITTER  
3. BASE

**CASE 317A-01  
ISSUE B**

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BFR96/D

