NPN diffused silicon planar transistors

BFX 94A - BFX 96A

RF amplifiers, high-speed switches

The BFX 94A and BFX 96A are NPN silicon planar epitaxial transistors designed to cover a wide range of RF amplifier and high-speed switching applications. These devices feature a minimum LV_{CEO} of 30 Volt, a minimum f_T of 250 MHz at I_C = 50 mA, V_{CE} = 10 V, together with a maximum $V_{CE\ sat}$ of 0.6 Volt at 500 mA and h_{FE} specified from 100 µA to 500 mA collector current.

ELECTRICAL CHARACTERISTICS
(T_A = 25°C unless otherwise noted)

Symbol	Characteristic and test conditions	Min.	Typ.	Max.	Unit
h_{FE}	DC Current Gain				
	I_C = 100 µA V_{CE} = 10 V	20	40		
	I_C = 1 mA V_{CE} = 10 V (5)	25	58		
	I_C = 10 mA V_{CE} = 10 V (5)	35	70		
	I_C = 150 mA V_{CE} = 1 V (5)	20	50		
	I_C = 150 mA V_{CE} = 10 V (5)	40	75	120	
	I_C = 500 mA V_{CE} = 10 V (5)	25	62		
$V_{BE\ sat}$	Base Saturation Voltage (5)				
	I_C = 150 mA I_B = 15 mA		0.9	1.1	V
	I_C = 500 mA I_B = 50 mA		1.1	1.5	V
$V_{CE\ sat}$	Collector Saturation Voltage (5)				
	I_C = 150 mA I_B = 15 mA		0.14	0.22	V
	I_C = 500 mA I_B = 50 mA		0.4	0.6	V
I_{CES}	Collector Reverse Current				
	V_{CE} = 50 V V_{EB} = 0		0.2	10	nA
	V_{CE} = 50 V V_{EB} = 0 125°C		0.2	10	µA
I_{EBO}	Emitter Reverse Current				
	V_{EB} = 3 V I_C = 0		0.1	10	nA
BV_{CBO}	Collector to Base Breakdown Voltage				
	I_C = 10 µA I_E = 0	60			V
BV_{EBO}	Emitter to Base Breakdown Voltage				
	I_E = 10 µA I_C = 0	5			V
LV_{CEO}	Collector to Emitter Sustaining Voltage (4 and 5)				
	I_C = 10 mA I_B = 0	30			V
h_{fe}	High Freq. Current Gain				
	I_C = 50 mA V_{CE} = 10 V f = 100MHz	2.5	4		
C_{TE}	Emitter Transition Capacitance				
	I_C = 0 V_{EB} = 2 V f = 1MHz		14	20	pF
C_{obo}	Base-Collector Capacitance				
	I_E = 0 V_{CB} = 10 V f = 1MHz		6	8	pF
t_{on}	Turn On Time (6)				
	I_C = 300 mA I_{B1} = 30 mA		14	60	ns
t_{off}	Turn Off Time (6)				
	I_C = 300 mA I_{B1} = 30 mA I_{B2} = −30 mA		80	150	ns
h_{ie}	Input Resistance				
	V_{CE} = 1 V I_C = 10 mA f = 1KHz		380		Ω
	V_{CE} = 10 V I_C = 10 mA f = 1KHz		460		Ω
	V_{CE} = 1 V I_C = 50 mA f = 1KHz		170		Ω
	V_{CE} = 10 V I_C = 50 mA f = 1KHz		350		Ω
h_{oe}	Output Conductance				
	V_{CE} = 1 V I_C = 10 mA f = 1KHz		410		µmho
	V_{CE} = 10 V I_C = 10 mA f = 1KHz		86		µmho
	V_{CE} = 1 V I_C = 50 mA f = 1KHz		950		µmho
	V_{CE} = 10 V I_C = 50 mA f = 1KHz		405		µmho
h_{re}	Voltage Feedback Ratio				
	V_{CE} = 1 V I_C = 10 mA f = 1KHz		2250		$\times 10^{-6}$
	V_{CE} = 10 V I_C = 10 mA f = 1KHz		130		$\times 10^{-6}$
	V_{CE} = 1 V I_C = 50 mA f = 1KHz		2650		$\times 10^{-6}$
	V_{CE} = 10 V I_C = 50 mA f = 1KHz		500		$\times 10^{-6}$
h_{fe}	Small Signal Current Gain				
	V_{CE} = 1 V I_C = 10 mA f = 1KHz		72		
	V_{CE} = 10 V I_C = 10 mA f = 1KHz		90		
	V_{CE} = 1 V I_C = 50 mA f = 1KHz		48		
	V_{CE} = 10 V I_C = 50 mA f = 1KHz		97		

NOTES:

(1) These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
(2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
(3) These ratings give a maximum junction temperature of 200°C and junction - to - case thermal resistance of 117°C/W (derating factor of 8.55 mW °C); junction - to - ambient thermal resistance of 438°C/W (derating factor of 2.28 mW. °C) for the BFX 94A.
Junction - to - case thermal resistance of 58.3°C/W (derating factor of 17.2 mW/°C); junction - to - ambient thermal resistance of 219°C/W (derating factor of 4.56 mW/°C) for the BFX 96A.
(4) These ratings refer to a high - current point where collector - to - emitter voltage is lowest. For more information send for SGS-AR 5.
(5) Measured under pulse conditions: pulse length = 300 µsec; duty cycle = 1%.
(6) See switching circuits for exact values of I_C, I_{B1} and I_{B2}

ABSOLUTE MAXIMUM RATINGS (1)
(T_A = 25°C unless otherwise noted)

Voltages

Collector to Base	V_{CBO}	60 V
Collector to Emitter (4)	V_{CEO}	30 V
Emitter to Base	V_{EBO}	5 V

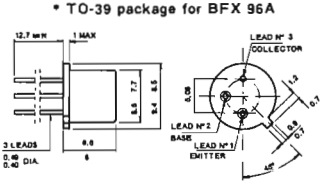
Temperatures

Storage Temperature Range	T_{STG}	-55°C to 200°C
Junction Temperature	T_J	200°C
Lead Temperature (Soldering, 10 sec. time limit)	T_L	260°C

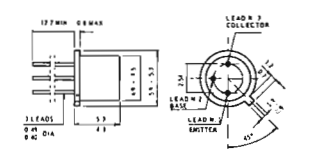
Power (2-3)

Dissipation at 25°C Case Temperature	BFX 94A	P_D	1.5 W
	BFX 96A	P_D	3 W
Dissipation at 25°C Ambient Temperature	BFX 94A	P_D	0.4 W
	BFX 96A	P_D	0.8 W

* TO-39 package for BFX 96A



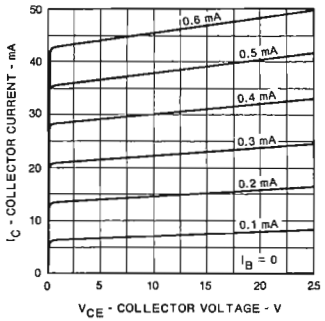
* TO-18 package for BFX 94A



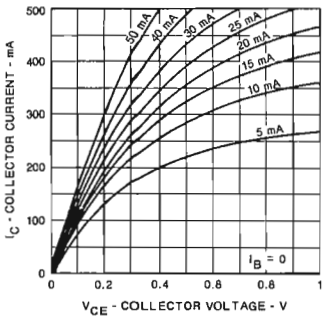
* Note: All dimensions in mm.

TYPICAL ELECTRICAL CHARACTERISTICS (25° C free air remperature unless otherwise noted)

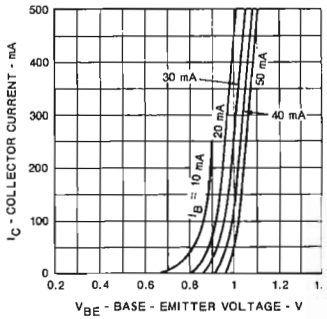
COLLECTOR CHARACTERISTICS *



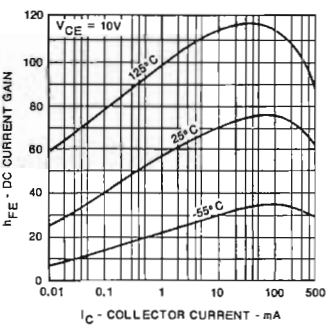
COLLECTOR CHARACTERISTICS *



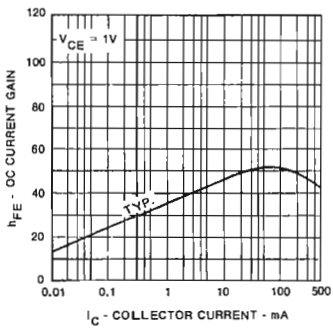
BASE CHARACTERISTICS



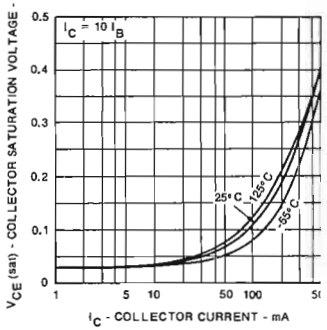
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



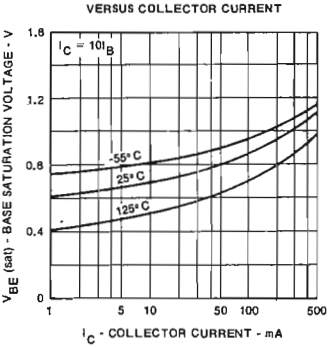
DC PULSE CURRENT GAIN VERSUS COLLECTOR CURRENT



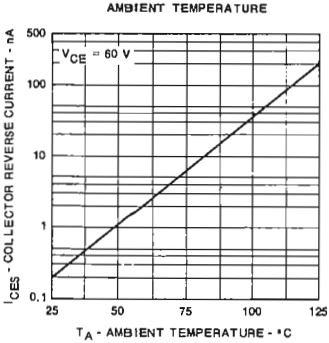
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



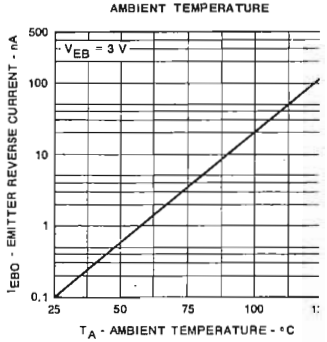
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



COLLECTOR REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



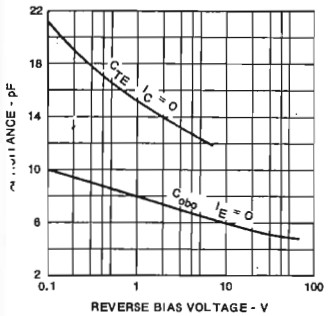
EMITTER REVERSE CURRENT VERSUS AMBIENT TEMPERATURE



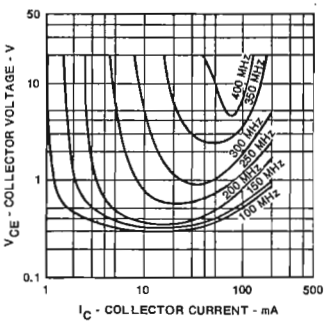
* Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS (25° C free air temperature unless otherwise noted)

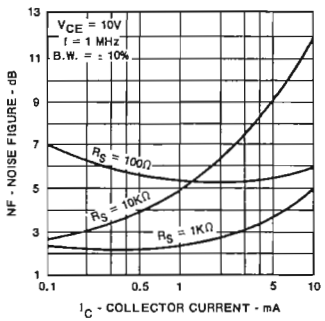
INPUT AND OUTPUT CAPACITANCE VERSUS REVERSE BIAS VOLTAGE



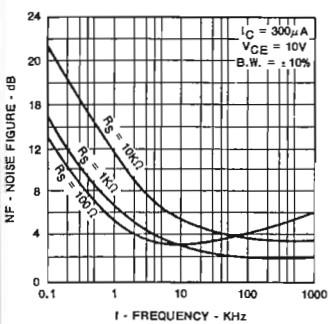
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_T)



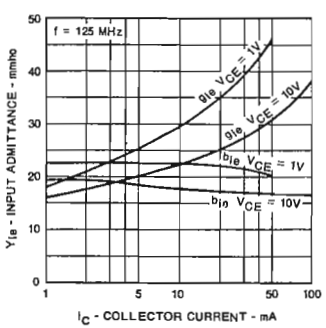
NOISE FIGURE VERSUS COLLECTOR CURRENT



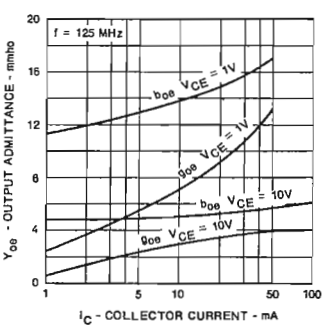
NOISE FIGURE VERSUS FREQUENCY



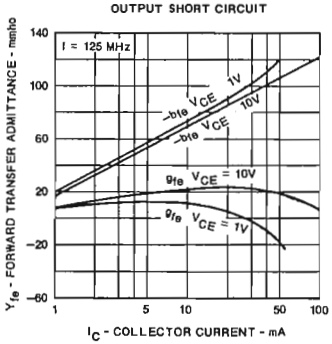
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT OUTPUT SHORT CIRCUIT



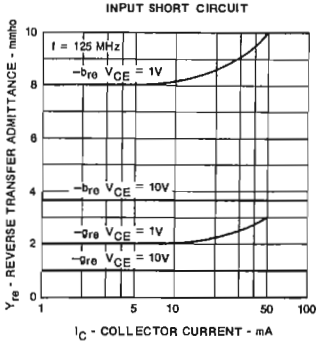
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT INPUT SHORT CIRCUIT



FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT OUTPUT SHORT CIRCUIT

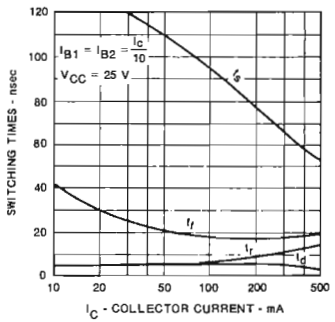


REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY INPUT SHORT CIRCUIT

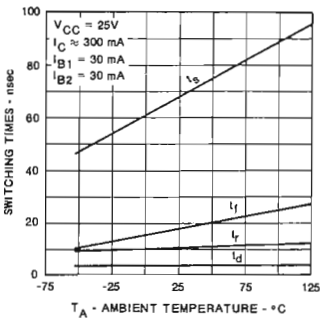


TYPICAL ELECTRICAL CHARACTERISTICS (25° C free air temperature unless otherwise noted)

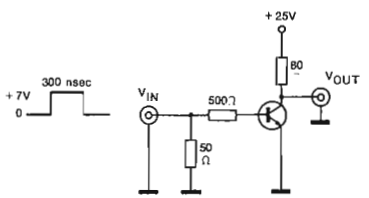
SWITCHING TIMES VERSUS COLLECTOR CURRENT



SWITCHING TIMES VERSUS TEMPERATURE



T_{on} TEST CIRCUIT



T_{off} TEST CIRCUIT