

BFX70-BFX71-BFX72

DUAL DIFFERENTIAL AMPLIFIERS

NPN DIFFUSED SILICON PLANAR TRANSISTORS

GENERAL DESCRIPTION-These six-terminal devices each contain two isolated high-gain NPN double-diffused silicon PLANAR transistors in one hermetically sealed enclosure. They are designed for use in high-performance differential amplifier circuits.

These devices are covered by Semiconductor Users Reliability Evaluation (SURE) Programme.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

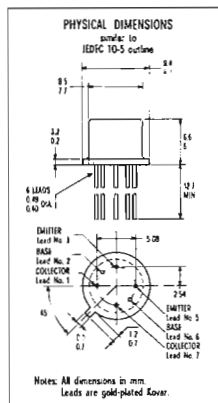
T_{STG}	Storage Temperature	-55°C to +200°C
T_J	Operating Junction Temperature	+200°C
T_L	Lead Temperature (Soldering, 10 sec time limit)	+260°C

Maximum Power Dissipations (Notes 2 and 3)

P_D	Total Dissipation of	One Side	Both Sides
	25°C Case Temperature	1.5 Watt	3 Watts
	at 100°C Case Temperature	0.86 Watt	1.7 Watt
	at 25°C Ambient Temperature	0.5 Watt	0.6 Watt

Maximum Voltages and Current for Each Transistor ($T_A = 25^\circ\text{C}$ unless otherwise noted)

V_{CBO}	Collector to Base Voltage	100 Volts
V_{CER}	Collector to Emitter Voltage (Note 4)	80 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	60 Volts
V_{EBO}	Emitter to Base Voltage	7 Volts
I_C	Collector Current	500 mA



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

SYMBOL	CHARACTERISTIC	BFX70		BFX71		BFX72		UNIT	TEST CONDITIONS
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
h_{FE1}	DC Current Gain Ratio (Note 8)	0.9	1	0.8	1	0.9	1		100 μA $V_{CE} = 5\text{ V}$
h_{FE2}									
h_{FE1}	DC Current Gain Ratio (Note 8)	0.9	1						1 mA $V_{CE} = 5\text{ V}$
h_{FE2}									
$ V_{BE1} - V_{BE2} $	Base-Emitter Voltage Difference		5		15		5	mV	$I_C = 100\text{ }\mu\text{A}$ $V_{CE} = 5\text{ V}$
$ V_{BE1} - V_{BE2} $	Base-Emitter Voltage Difference		5					mV	$I_C = 1\text{ mA}$ $V_{CE} = 5\text{ V}$
$\frac{\Delta(V_{BE1} - V_{BE2})}{\Delta T}$	Temperature Coefficient of Base-Emitter Voltage Difference ($T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$)		10		25		25	$\mu\text{V}/^\circ\text{C}$	$I_C = 100\text{ }\mu\text{A}$ $V_{CE} = 5\text{ V}$

NOTES:

- These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
- These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- These ratings give a maximum junction temperature of 200°C and junction-to-case thermal resistance of 117°C/watt (derating factor of 8.6 mW/°C) for one side; 58.3°C/watt (derating factor of 17.2 mW/°C) for both sides. Junction-to-ambient thermal resistance of 350°C/watt (derating factor of 2.86 mW/°C) for one side; 292°C/watt (derating factor of 3.42 mW/°C) for both sides.
- Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for SGS-AR 5.
- Lowest of the two h_{FE} readings is taken as h_{FE1} for purposes of this ratio.

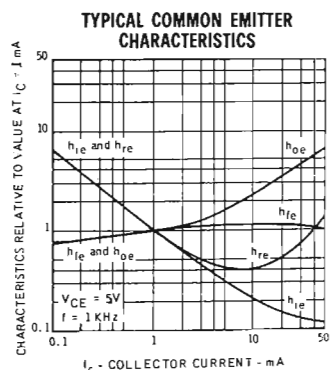
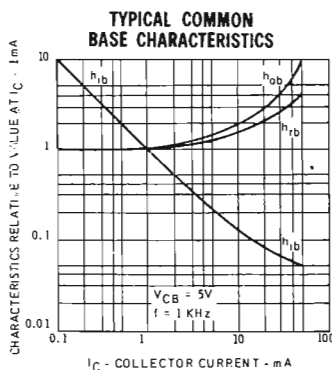
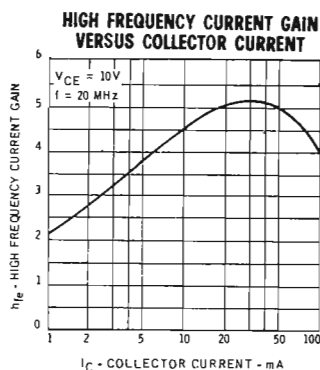
ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

SYMBOL	CHARACTERISTIC	BFX 70			BFX 71 BFX 72			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
h_{FE}	DC Current Gain	25	50	75	15	50			$I_C = 10 \mu A$ $V_{CE} = 5 V$
h_{FE}	DC Current Gain	30	60	90	25	65	150		$I_C = 100 \mu A$ $V_{CE} = 5 V$
h_{FE}	DC Pulse Current Gain (Note 5)	40	80	120					$I_C = 1 mA$ $V_{CE} = 5 V$
h_{FE}	DC Pulse Current Gain (Note 5)	50	100	150	50	125	200		$I_C = 10 mA$ $V_{CE} = 5 V$
$V_{BE sat}$	Base Saturation Voltage (Note 5)		0.7	0.9		0.7	0.9	V	$I_C = 50 mA$ $I_B = 5 mA$
$V_{CE sat}$	Collector Saturation Voltage (Note 5)		0.35	1.2		0.35	1.2	V	$I_C = 50 mA$ $I_B = 5 mA$
I_{CBO}	Collector Cutoff Current		0.4	2		0.4	10	nA	$I_E = 0$ $V_{CB} = 80 V$
$I_{CBO} (125^\circ C)$	Collector Cutoff Current		1.3	10		1.3	15	μA	$I_E = 0$ $V_{CB} = 80 V$
BV_{CBO}	Collector to Base Breakdown Voltage	100			100			V	$I_C = 100 \mu A$ $I_E = 0$
LV_{CER}	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	80			80			V	$I_C = 100 mA$ $R_{BE} \leq 10 \Omega$
LV_{CEO}	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	60			60			V	$I_C = 30 mA$ (pulsed) $I_B = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7			7			V	$I_C = 0$ $I_E = 100 \mu A$
I_{EBO}	Emitter Cutoff Current		0.1	2		0.1	10	nA	$I_C = 0$ $V_{EB} = 5 V$
h_{fe}	High Frequency Current Gain ($f = 20 MHz$)	3	5		2.5	5			$I_C = 50 mA$ $V_{CE} = 10 V$
C_{obo}	Base-Collector Capacitance		12	15		12	15	pF	$I_E = 0$ $V_{CB} = 10 V$
C_{TE}	Emitter Transition Capacitance		60	85		60	85	pF	$I_C = 0$ $V_{EB} = 0.5 V$
NF	Narrow Band Noise Figure (Note 6)		3.2	8				dB	$I_C = 0.3 mA$ $V_{CE} = 10 V$
NF	Broad Band Noise Figure (Note 7)			8				dB	$I_C = 0.3 mA$ $V_{CE} = 10 V$
h_{fe}	Small Signal Current Gain ($f = 1 KHz$)	50	80	150	40	125	200		$I_C = 1 mA$ $V_{CE} = 5 V$
h_{ie}	Input Resistance ($f = 1 KHz$)	1	2.3	4				K Ω	$I_C = 1 mA$ $V_{CE} = 5 V$
h_{oe}	Output Conductance ($f = 1 KHz$)	4	9	16				$\mu mhos$	$I_C = 1 mA$ $V_{CE} = 5 V$
h_{ib}	Input Resistance ($f = 1 KHz$)	20	27	30	20	27	30	Ω	$I_C = 1 mA$ $V_{CB} = 5 V$
h_{ob}	Output Conductance ($f = 1 KHz$)					0.2	0.5	$\mu mhos$	$I_C = 1 mA$ $V_{CB} = 5 V$
h_{rb}	Voltage Feedback Ratio ($f = 1 KHz$)					0.9	3	$\times 10^{-4}$	$I_C = 1 mA$ $V_{CB} = 5 V$

NOTES:

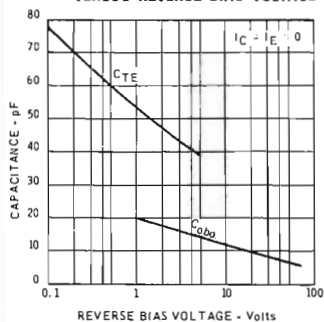
- (5) Pulse Conditions: length = 300 μsec ; duty cycle = 1%.
- (6) Frequency = 1000 Hz, 200 Hz power bandwidth, $R_G = 510 \Omega$. For more information send for SGS-AR 5.
- (7) $R_G = 1 K\Omega$. The amplifier used for this measurement has a power bandwidth of 15.7 KHz and a response which rolls off of 6 dB per octave where the 3dB points are approximately at 25 Hz and 10 KHz.

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

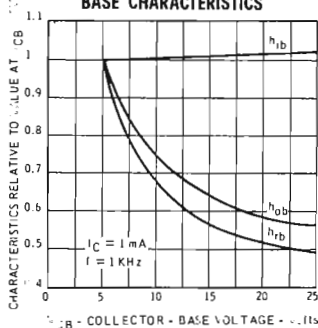


TYPICAL ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

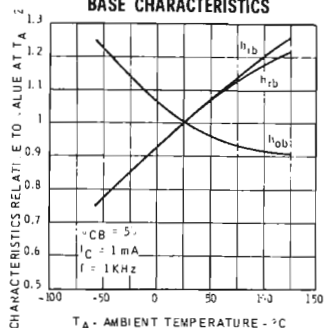
**INPUT AND OUTPUT CAPACITANCE
VERSUS REVERSE BIAS VOLTAGE**



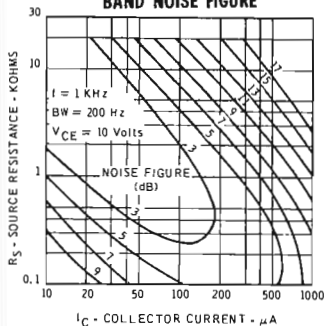
**TYPICAL COMMON
BASE CHARACTERISTICS**



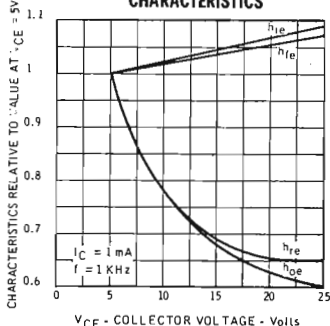
**TYPICAL COMMON
BASE CHARACTERISTICS**



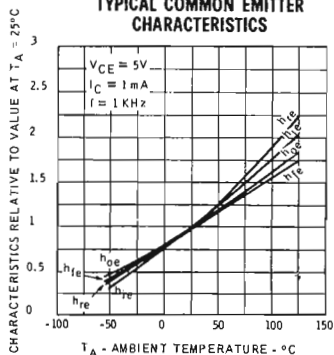
**CONTOURS OF CONSTANT NARROW
BAND NOISE FIGURE**



**TYPICAL COMMON EMITTER
CHARACTERISTICS**

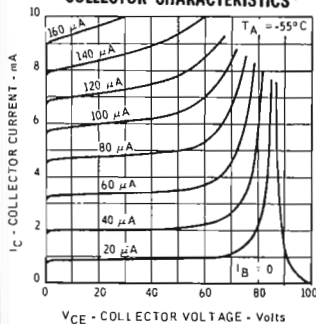


**TYPICAL COMMON EMITTER
CHARACTERISTICS**

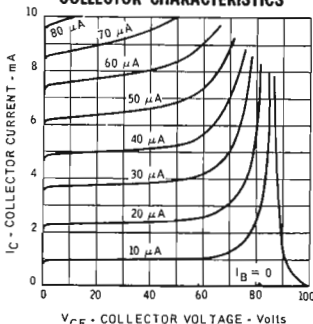


BFX 71•BFX 72

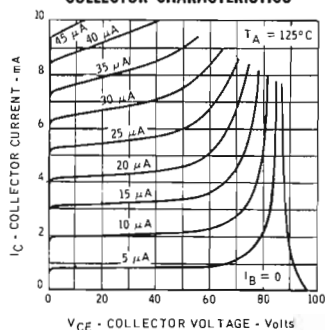
COLLECTOR CHARACTERISTICS*



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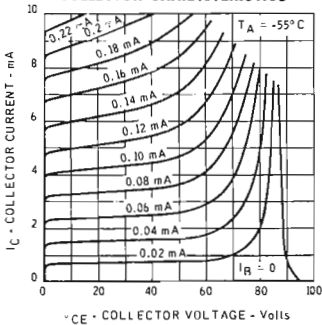


* Single family characteristics on Transistor Curve Tracer.

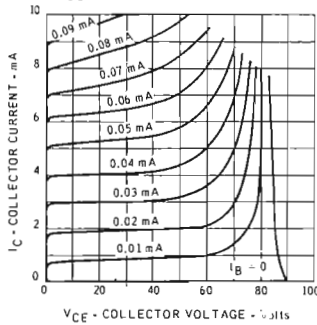
TYPICAL ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

BFX70

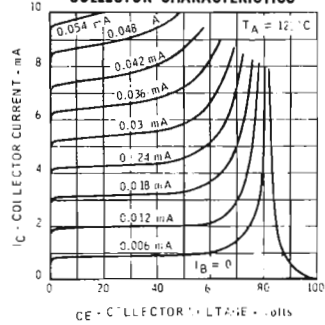
COLLECTOR CHARACTERISTICS*



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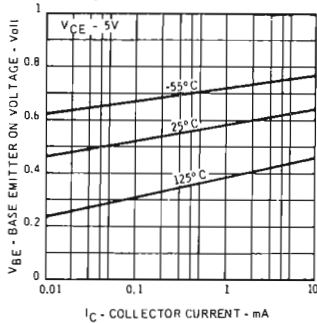
COLLECTOR CHARACTERISTICS*



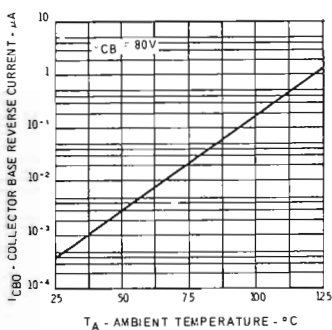
*Single family characteristics on Transistor Curve Tracer.

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**BASE-EMITTER ON VOLTAGE
VERSUS COLLECTOR CURRENT**

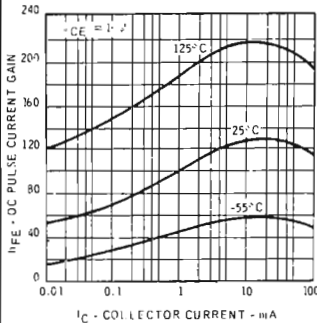


**COLLECTOR-BASE REVERSE
CURRENT VERSUS TEMPERATURE**

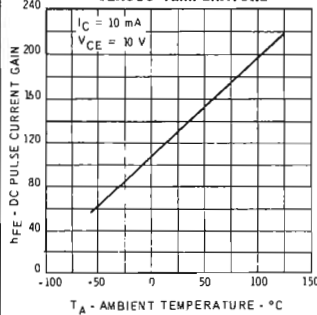


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**DC PULSE CURRENT GAIN
VERSUS COLLECTOR CURRENT**

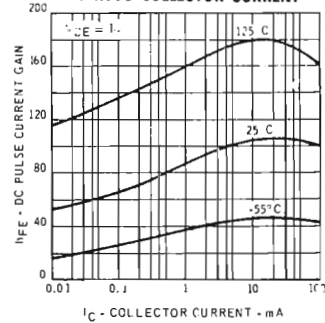


**DC PULSE CURRENT GAIN
VERSUS TEMPERATURE**



BFX70

**DC PULSE CURRENT GAIN
VERSUS COLLECTOR CURRENT**



**DC PULSE CURRENT GAIN
VERSUS TEMPERATURE**

