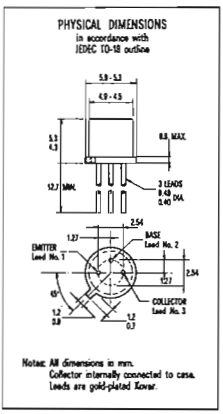
BSX 29

HIGH-SPEED SWITCH AND RF AMPLIFIER

PNP DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTOR

GENERAL DESCRIPTION - The BSX 29 is a 700 Mc/s PNP silicon PLANAR epitaxial transistor designed for saturated and nonsaturated switching circuits requiring up to 200 milliamperes of collector current. It is suitable for 20 Mc/s amplifiers, 10.7 Mc/s IF amplifiers, and 100 Mc/s oscillator converter circuits.



ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Temperatures

Storage Temperature	-65°C to + 200°C
Operating Junction Temperature	200°C Maximum
Lead Temperature (Soldering, 60 sec Time Limit)	300°C Maximum

Maximum Power Dissipations

Total Dissipation at 25°C Case Temperature (Notes 2 and 3)	1.2 Watts
at 25°C Ambient Temperature (Notes 2 and 3)	0.36 Watt

Maximum Voltages

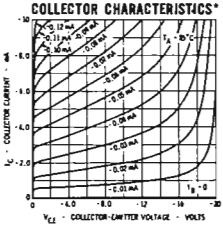
V_{CBO}	Collector to Base Voltage	-12 Volts
V_{CEO}	Collector to Emitter Voltage (Note 4)	-12 Volts
V_{CES}	Collector to Emitter Voltage	-12 Volts
V_{EBO}	Emitter to Base Voltage	-4.0 Volts

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

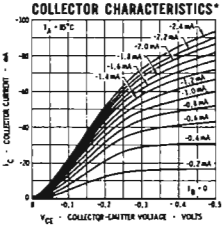
SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
h_{FE}	DC Pulse Current Gain (Note 5)	25	50			I_C = 10 mA V_{CE} = - 0.3 V
h_{FE}	DC Pulse Current Gain (Note 5)	30	60	120		I_C = 30 mA V_{CE} = - 0.5 V
h_{FE}	DC Pulse Current Gain (Note 5)	20	40			I_C = 100 mA V_{CE} = - 1.0 V
V_{BE} (sat)	Base Saturation Voltage	-0.78	-0.96	-0.98	V	I_C = 10 mA I_B = 1.0 mA
V_{BE} (sat)	Base Saturation Voltage	-0.85	-1.12	-1.2	V	I_C = 30 mA I_B = 3.0 mA
V_{BE} (sat)	Base Saturation Voltage		-1.4	-1.7	V	I_C = 100 mA I_B = 10 mA
V_{CE} (sat)	Collector Saturation Voltage		-0.07	-0.15	V	I_C = 10 mA I_B = 1.0 mA
V_{CE} (sat)	Collector Saturation Voltage		-0.1	-0.2	V	I_C = 30 mA I_B = 3.0 mA
V_{CE} (sat)	Collector Saturation Voltage		-0.25	-0.5	V	I_C = 100 mA I_B = 10 mA
V_{CE} (sat)(85°C)	Collector Saturation Voltage		-0.15	-0.4	V	I_C = 30 mA I_B = 3.0 mA
I_{CES}	Collector Reverse Current		0.05	80	nA	V_{CE} = -6.0 V V_{BE} = 0
I_{CES} (85°C)	Collector Reverse Current		0.003	5.0	µA	V_{CE} = -6.0 V V_{BE} = 0
BV_{CBO}	Collector to Base Breakdown Voltage	-12			V	I_C = 10 µA I_E = 0
BV_{CES}	Collector to Emitter Breakdown Voltage	-12			V	I_C = 10 µA I_E = 0
BV_{EBO}	Emitter to Base Breakdown Voltage	-4.0			V	I_E = 100 µA I_C = 0
V_{CEO} (sust)	Collector to Emitter Sustaining Voltage (Notes 4 and 5)	-12			V	I_C = 10 mA (pulsed) I_B = 0
h_{fe}	High Frequency Current Gain (f = 100 Mc/s)	4.0	7.0			I_C = 30 mA V_{CE} = - 10 V
C_{ob}	Output Capacitance		3.3	6.0	pF	I_E = 0 V_{CB} = - 5.0 V
C_{TE}	Emitter Transition Capacitance		3.8	6.0	pF	I_C = 0 V_{EB} = - 0.5 V
t_{on}	Turn On Time (Note 6)		25	60	nsec	I_C = 30 mA I_{B1} = 1.5 mA
t_{off}	Turn Off Time (Note 6)		35	90	nsec	I_C = 30mA, I_{B1} = 1.5mA, I_{B2} = -1.5mA

TYPICAL ELECTRICAL CHARACTERISTICS

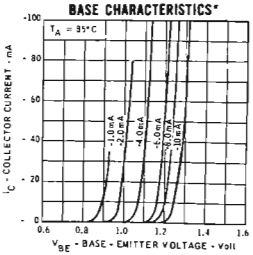
COLLECTOR CHARACTERISTICS*



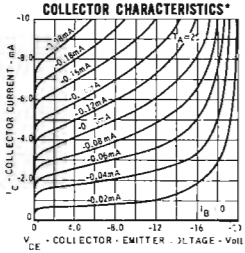
COLLECTOR CHARACTERISTICS*



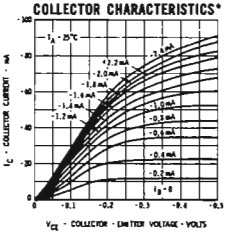
BASE CHARACTERISTICS*



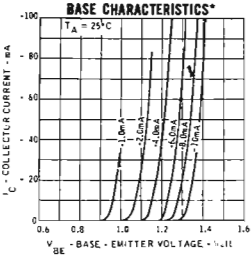
COLLECTOR CHARACTERISTICS*



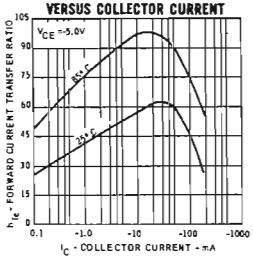
COLLECTOR CHARACTERISTICS*



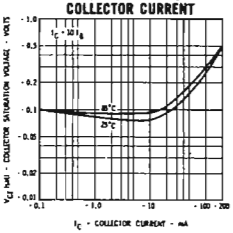
BASE CHARACTERISTICS*



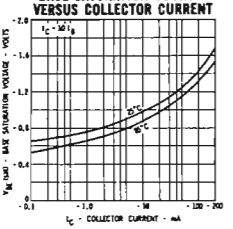
PULSED DC CURRENT GAIN VERSUS COLLECTOR CURRENT



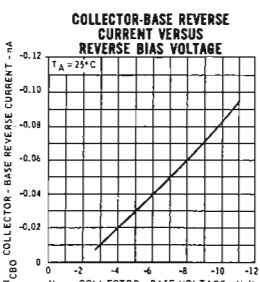
COLLECTOR SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



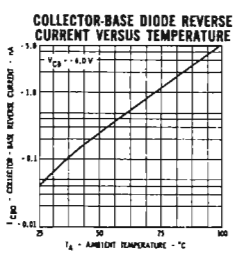
BASE SATURATION VOLTAGE VERSUS COLLECTOR CURRENT



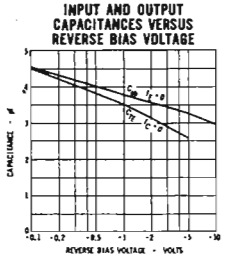
COLLECTOR-BASE REVERSE CURRENT VERSUS REVERSE BIAS VOLTAGE



COLLECTOR-BASE DIODE REVERSE CURRENT VERSUS TEMPERATURE



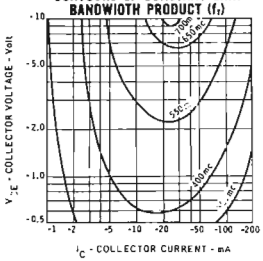
INPUT AND OUTPUT CAPACITANCES VERSUS REVERSE BIAS VOLTAGE



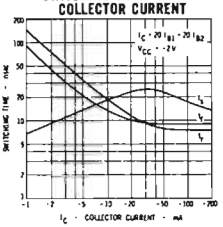
*Single family characteristics on Transistor Curve Tracer.

TYPICAL ELECTRICAL CHARACTERISTICS

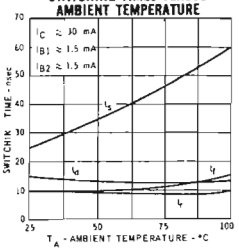
CONTOURS OF CONSTANT GAIN BANDWIDTH PRODUCT (f_t)



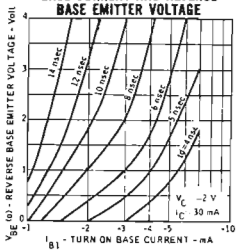
SWITCHING TIMES VERSUS COLLECTOR CURRENT



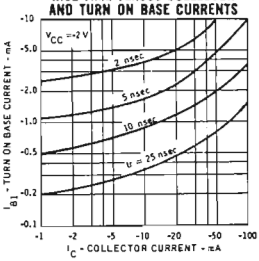
SWITCHING TIMES VERSUS AMBIENT TEMPERATURE



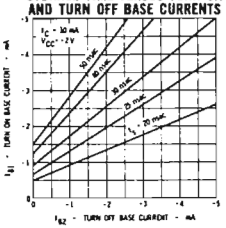
DELAY TIME VERSUS TURN ON BASE CURRENT AND REVERSE BASE EMITTER VOLTAGE



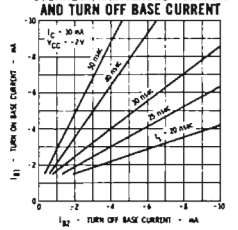
RISE TIME VERSUS COLLECTOR AND TURN ON BASE CURRENTS



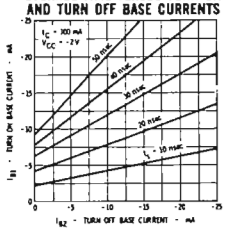
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



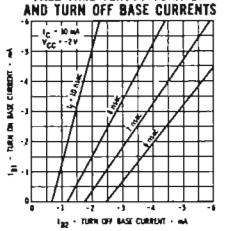
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



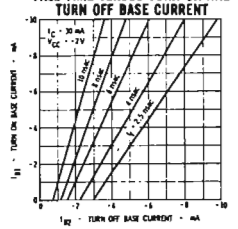
STORAGE TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



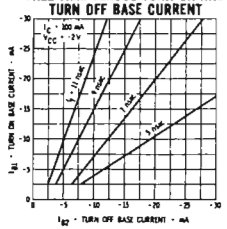
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENTS



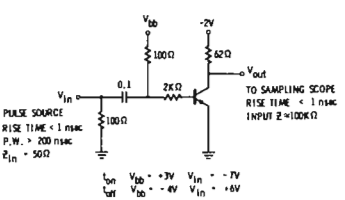
FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENT



FALL TIME VERSUS TURN ON AND TURN OFF BASE CURRENT

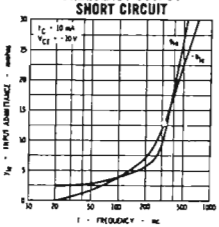


SWITCHING TIME TEST CIRCUIT

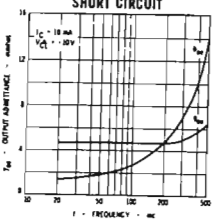


TYPICAL ELECTRICAL CHARACTERISTICS

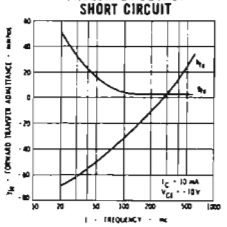
INPUT ADMITTANCE VERSUS FREQUENCY-OUTPUT SHORT CIRCUIT



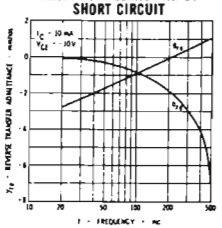
OUTPUT ADMITTANCE VERSUS FREQUENCY-INPUT SHORT CIRCUIT



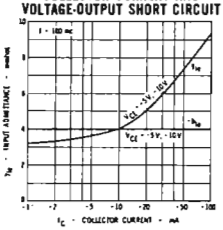
FORWARD TRANSFER ADMITTANCE VERSUS FREQUENCY-OUTPUT SHORT CIRCUIT



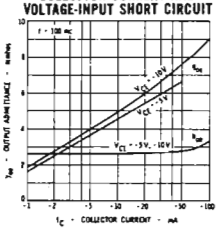
REVERSE TRANSFER ADMITTANCE VERSUS FREQUENCY-INPUT SHORT CIRCUIT



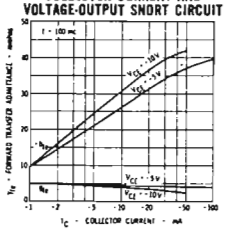
INPUT ADMITTANCE VERSUS COLLECTOR CURRENT AND VOLTAGE-OUTPUT SHORT CIRCUIT



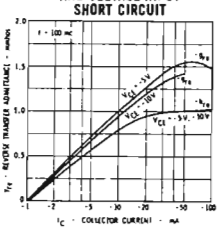
OUTPUT ADMITTANCE VERSUS COLLECTOR CURRENT AND VOLTAGE-INPUT SHORT CIRCUIT



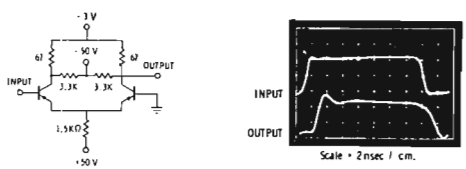
FORWARD TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT AND VOLTAGE-OUTPUT SHORT CIRCUIT



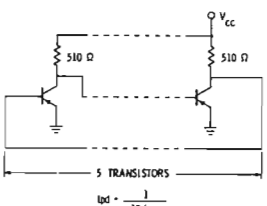
REVERSE TRANSFER ADMITTANCE VERSUS COLLECTOR CURRENT AND VOLTAGE-INPUT SHORT CIRCUIT



NON SATURATED SWITCHING PERFORMANCE

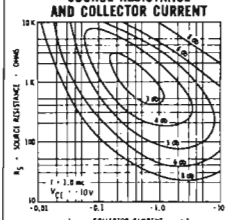


FIVE STAGE RING OSCILLATOR FOR MEASUREMENT OF PROPAGATION DELAY

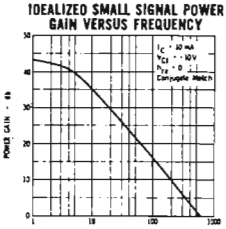


$$t_{pd} = \frac{1}{10\, f_{OSC}}$$

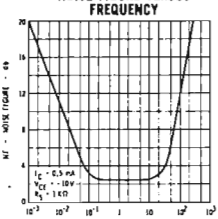
NOISE FIGURE VERSUS SOURCE RESISTANCE AND COLLECTOR CURRENT



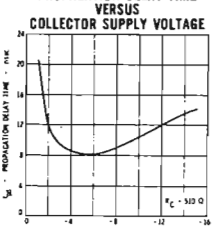
IDEALIZED SMALL SIGNAL POWER GAIN VERSUS FREQUENCY



NOISE FIGURE VERSUS FREQUENCY



PROPAGATION DELAY TIME VERSUS COLLECTOR SUPPLY VOLTAGE



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 146°C/watt (derating factor of 6.85 mW/°C). Junction-to-ambient thermal resistance of 486°C/watt (derating factor of 2.06 mW/°C).

(4) Rating refers to a high-current point where collector-to-emitter voltage is lowest. For more information send for SGS Publication AR 5.

(5) Pulse Conditions: length = 300 μsec; duty cycle = 1%.

(6) See switching circuits for exact values of I_C, I_{B1}, and I_{B2}.