

TYPES 2N3903, 2N3904, A5T3903, A5T3904

N-P-N SILICON TRANSISTORS

*electrical characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	2N3903, A5T3903		2N3904, A5T3904		UNIT
		MIN	MAX	MIN	MAX	
$V_{(BR)CBO}$ Collector-Base Breakdown Voltage	$I_C = 10 \mu A, I_E = 0$	60		60		V
$V_{(BR)CEO}$ Collector-Emitter Breakdown Voltage	$I_C = 1 mA, I_B = 0$, See Note 3	40		40		V
$V_{(BR)EBO}$ Emitter-Base Breakdown Voltage	$I_E = 10 \mu A, I_C = 0$	6		6		V
I_{CEV} Collector Cutoff Current	$V_{CE} = 30 V, V_{BE} = -3 V$		50		50	nA
I_{BEV} Base Cutoff Current	$V_{CE} = 30 V, V_{BE} = -3 V$		-50		-50	nA
h_{FE} Static Forward Current Transfer Ratio	$V_{CE} = 1 V, I_C = 100 \mu A$	20		40		
	$V_{CE} = 1 V, I_C = 1 mA$	35		70		
	$V_{CE} = 1 V, I_C = 10 mA$	50	150	100	300	
	$V_{CE} = 1 V, I_C = 50 mA$	30		50		
	$V_{CE} = 1 V, I_C = 100 mA$	15		30		
V_{BE} Base-Emitter Voltage	$I_B = 1 mA, I_C = 10 mA$	0.65	0.85	0.65	0.85	V
	$I_B = 5 mA, I_C = 50 mA$		0.95		0.95	
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_B = 1 mA, I_C = 10 mA$		0.2		0.2	V
	$I_B = 5 mA, I_C = 50 mA$		0.3		0.3	
h_{ie} Small-Signal Common-Emitter Input Impedance	$V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz$	1	8	1	10	k Ω
h_{fe} Small-Signal Common-Emitter Forward Current Transfer Ratio		50	200	100	400	
h_{re} Small-Signal Common-Emitter Reverse Voltage Transfer Ratio		0.1 x 10 ⁻⁴	5 x 10 ⁻⁴	0.5 x 10 ⁻⁴	8 x 10 ⁻⁴	
h_{oe} Small-Signal Common-Emitter Output Admittance		1	40	1	40	μmho
$ h_{fe} $ Small-Signal Common-Emitter Forward Current Transfer Ratio		$V_{CE} = 20 V, I_C = 10 mA, f = 100 MHz$	2.5		3	
f_T Transition Frequency	$V_{CE} = 20 V, I_C = 10 mA$, See Note 4	250		300		MHz
C_{ob0} Common-Base Open-Circuit Output Capacitance	$V_{CB} = 5 V, I_E = 0, f = 100 kHz$ to 1 MHz		4		4	pF
C_{ib0} Common-Base Open-Circuit Input Capacitance	$V_{EB} = 0.5 V, I_C = 0, f = 100 kHz$ to 1 MHz		8		8	pF

NOTES: 3. These parameters must be measured using pulse techniques. $t_w = 300 \mu s$, duty cycle $< 2\%$.

4. To obtain f_T , the $|h_{fe}|$ response with frequency is extrapolated at the rate of -6 dB per octave from $f = 100 MHz$ to the frequency at which $|h_{fe}| = 1$.

*operating characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	2N3903 A5T3903		2N3904 A5T3904		UNIT
		MIN	MAX	MIN	MAX	
\overline{NF} Average Noise Figure	$V_{CE} = 5 V, I_C = 100 \mu A, R_G = 1 k\Omega$, Noise Bandwidth = 15.7 kHz, See Note 5		6		5	dB

NOTE 5: Average Noise Figure is measured in an amplifier with response down 3 dB at 10 Hz and 10 kHz and a high-frequency rolloff of 6 dB/octave.

*The asterisk identifies JEDEC registered data for the 2N3903 and 2N3904 only.