

TYPES 2N3903, 2N3904, A5T3903, A5T3904

N-P-N SILICON TRANSISTORS

BULLETIN NO. DL S 7311576 NOVEMBER 1971 - REVISED MARCH 1973

SILECT[†] TRANSISTORS:

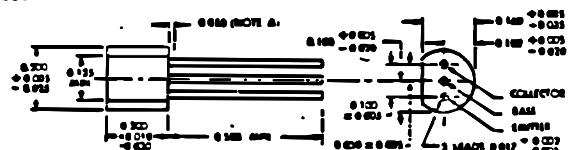
FOR GENERAL PURPOSE SATURATED-SWITCHING AND AMPLIFIER APPLICATIONS

- For Complementary Use with P-N-P Types 2N3905, 2N3906, A5T3905, and A5T3906
- Rugged One-Piece Construction with In-Line Leads or Standard TO-18 100-mil Pin-Circle Configuration

mechanical data

These transistors are encapsulated in a plastic compound specifically designed for this purpose, using a highly mechanized process developed by Texas Instruments. The case will withstand soldering temperatures without deformation. These devices exhibit stable characteristics under high-humidity conditions and are capable of meeting MIL-STD-202C, Method 106B. The transistors are insensitive to light.

2N3903, 2N3904

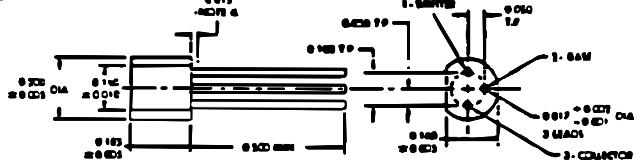


NOTES: A. Lead diameter is not controlled in this area.
B. All dimensions are in inches.

*ALL JEDEC TO-92 DIMENSIONS AND NOTES ARE APPLICABLE



A5T3903, A5T3904



NOTES: A. Lead diameter is not controlled in this area
B. Leads having maximum diameter ID 0.019 shall be within 0.007 of their true positions measured in the gaging plane 0.054 below the seating plane of the device relative to a maximum-diameter package
C. All dimensions are in inches

absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

Collector-Base Voltage	60 V*
Collector-Emitter Voltage (See Note 1)	40 V*
Emitter-Base Voltage	6 V*
Continuous Collector Current	200 mA*
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 2)	{ 625 mW\$ 310 mW*
Storage Temperature Range	{ -65°C to 150°C\$ -55°C to 135°C*
Lead Temperature 1/16 Inch from Case for 60 Seconds	{ 260°C\$ 230°C*

NOTES 1. This value applies between 10 μA and 200 mA collector current when the base-emitter diode is open-circuited.
2. Derate the 625-mW rating linearly to 150°C free-air temperature at the rate of 5 mW/°C. Derate the 310-mW (JEDEC registered) rating linearly to 135°C free-air temperature at the rate of 2.81 mW/°C.

*The asterisk identifies JEDEC registered data for the 2N3903 and 2N3904 only. This data sheet contains all applicable registered data in effect at the time of publication.

[†]Trademark of Texas Instruments

\$U.S. Patent No. 3,439,238

†Texas Instruments guarantees these values in addition to the JEDEC registered values which are also shown.

USES CHIP N14

4-283

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

219

TYPES 2N3903, 2N3904, AST3903, AST3904
N-P-N SILICON TRANSISTORS

*electrical characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS	2N3903, AST3903		2N3904, AST3904		UNIT
		MIN	MAX	MIN	MAX	
V _{BRICBO} Collector-Base Breakdown Voltage	I _C = 10 μA, I _E = 0	60	60	60	60	V
V _{BRICEO} Collector-Emitter Breakdown Voltage	I _C = 1 mA, I _B = 0, See Note 3	40	40	40	40	V
V _{BRIEBO} Emitter-Base Breakdown Voltage	I _E = 10 μA, I _C = 0	6	6	6	6	V
I _{CEV} Collector Cutoff Current	V _{CE} = 30 V, V _{BE} = -3 V	50	50	50	50	mA
I _{BEV} Base Cutoff Current	V _{CE} = 30 V, V _{BE} = -3 V	-50	-50	-50	-50	mA
h _{FE} Static Forward Current Transfer Ratio	V _{CE} = 1 V, I _C = 100 μA	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	60			
	V _{CE} = 1 V, I _C = 100 mA	15	30			
V _{BE} Base Emitter Voltage	I _B = 1 mA, I _C = 10 mA	See Note 3	0.65	0.85	0.65	0.85
	I _B = 5 mA, I _C = 50 mA		0.95	0.95		V
	I _B = 1 mA, I _C = 10 mA	See Note 3	0.2	0.2		V
V _{CESAT} Collector-Emitter Saturation Voltage	I _B = 5 mA, I _C = 50 mA	See Note 3	0.3	0.3		V
	I _B = 1 mA, I _C = 10 mA					
	I _B = 5 mA, I _C = 50 mA					
h _{ie} Small-Signal Common Emitter Input Impedance	V _{CE} = 10 V,		1	8	1	10
			50	200	100	400
	I _C = 1 mA,		0.1 × 10 ⁻⁴	5 × 10 ⁻⁴	0.5 × 10 ⁻⁴	8 × 10 ⁻⁴
	I = 1 kHz		10 ⁻⁴	10 ⁻⁴	10 ⁻⁴	10 ⁻⁴
			1	40	1	40
h _{oe} Small-Signal Common Emitter Output Admittance	V _{CE} = 20 V, I _C = 10 mA, f = 100 MHz	2.5	3			
	V _{CE} = 20 V, I _C = 10 mA, See Note 4	250	300			MHz
	V _{CB} = 5 V, I _E = 0, f = 100 kHz to 1 MHz		4	4		pF
C _{bo} Common-Base Open-Circuit Output 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 μs, 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 AST3903		2N3904 AST3904		UNIT
		MIN	MAX	MIN	MAX	
NF Average Noise Figure	V _{CE} = 5 V, I _C = 100 μA, R _G = 1 kΩ, 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 roll-off of 6 dB/octave.

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