

# 2N3903 2N3904

NPN SILICON PLANAR EPITAXIAL TRANSISTORS

CASE TO-92A

2N3903, 2N3904 are NPN silicon planar epitaxial transistors designed for general purpose switching and amplifier applications. They are complementary to PNP types 2N3905 and 2N3906.



EBC

## ABSOLUTE MAXIMUM RATINGS

Collector-Base Voltage	V <sub>CB0</sub>	60V
Collector-Emitter Voltage	V <sub>CE0</sub>	40V
Emitter-Base Voltage	V <sub>EB0</sub>	6V
Collector Current	I <sub>C</sub>	200mA
Total Power Dissipation @ T <sub>A</sub> =25°C	P <sub>tot</sub>	350mW
		1W
Operating Junction & Storage Temperature	T <sub>j</sub> , T <sub>stg</sub>	-55 to +150°C

## ELECTRICAL CHARACTERISTICS @ T<sub>A</sub>=25°C

PARAMETER	SYMBOL	2N3903		2N3904		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
Collector-Base Breakdown Voltage	BV <sub>CB0</sub>	60		60		V	I <sub>C</sub> =10μA IE=0
Collector-Emitter Breakdown Voltage	BV <sub>CE0</sub> *	40		40		V	I <sub>C</sub> =1mA IB=0
Emitter-Base Breakdown Voltage	BV <sub>EB0</sub>	6		6		V	IE=10μA IC=0
Collector Cutoff Current	I <sub>CEV</sub>		50		50	nA	V <sub>CE</sub> =30V V <sub>EB</sub> =3V
Base Cutoff Current	I <sub>BEV</sub>		50		50	nA	V <sub>CE</sub> =30V V <sub>EB</sub> =3V
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub> *	0.2		0.2		V	I <sub>C</sub> =10mA IB=1mA
		0.3		0.3		V	I <sub>C</sub> =50mA IB=5mA
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub> *	0.65	0.85	0.65	0.85	V	I <sub>C</sub> =10mA IB=1mA
			0.95		0.95	V	I <sub>C</sub> =50mA IB=5mA
D.C. Current Gain	H <sub>FE</sub> *	20		40			I <sub>C</sub> =0.1mA V <sub>CE</sub> =1V
		35		70			I <sub>C</sub> =1mA V <sub>CE</sub> =1V
		50	150	100	300		I <sub>C</sub> =10mA V <sub>CE</sub> =1V
		30		60			I <sub>C</sub> =50mA V <sub>CE</sub> =1V
		15		30			I <sub>C</sub> =100mA V <sub>CE</sub> =1V
Current Gain-Bandwidth Product	f <sub>T</sub>	250		300		MHz	I <sub>C</sub> =10mA V <sub>CE</sub> =20V

\* Pulse Test : Pulse Width=0.3ms, Duty Cycle=1%

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P.T.O.

6.79.9600

PARAMETER	SYMBOL	2N3903		2N3904		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
Output Capacitance	Cob		4		4	pF	V <sub>CB</sub> =5V I <sub>E</sub> =0 f=100kHz
Input Capacitance	Cib		8		8	pF	V <sub>EB</sub> =0.5V I <sub>C</sub> =0 f=100kHz
Noise Figure	NF		6		5	dB	I <sub>C</sub> =100μA V <sub>CE</sub> =5V R <sub>S</sub> =1KΩ f=10Hz to 15.7kHz
Input Impedance	h <sub>ie</sub>	0.5	8	1	10	kΩ	I <sub>C</sub> =1mA V <sub>CE</sub> =10V f=1kHz
Voltage Feedback Ratio	h <sub>re</sub>	0.1	5	0.5	8	<sup>-4</sup> x10	I <sub>C</sub> =1mA V <sub>CE</sub> =10V f=1kHz
Small Signal Current Gain	h <sub>fe</sub>	50	200	100	400		I <sub>C</sub> =1mA V <sub>CE</sub> =10V f=1kHz
Output Admittance	h <sub>oe</sub>	1	40	1	40	μS	I <sub>C</sub> =1mA V <sub>CE</sub> =10V f=1kHz
Delay Time	t <sub>d</sub>		35		35	ns	V <sub>CC</sub> =3V V <sub>CE</sub> =0.5V I <sub>C</sub> =10mA
Rise Time	t <sub>r</sub>		35		35	ns	I <sub>B1</sub> =1mA
Storage Time	t <sub>s</sub>		175		200	ns	V <sub>CC</sub> =3V I <sub>B1</sub> =I <sub>B2</sub> =1mA
Fall Time	t <sub>f</sub>		50		50	ns	I <sub>C</sub> =10mA