

2N3904

General Purpose Transistors NPN TO-92



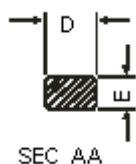
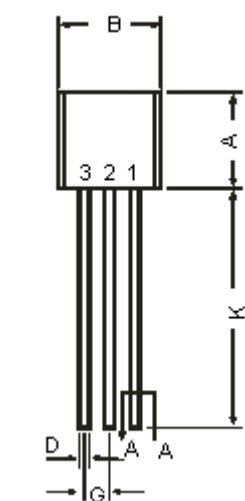
High Speed Switching



Features:

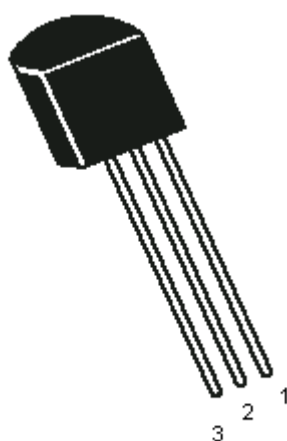
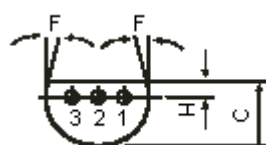
- NPN Silicon Planar Switching Transistors.
- Fast switching devices exhibiting short turn-off and low saturation voltage characteristics.
- General purpose Switching and Amplifier Applications.

TO-92 Plastic Package



Dimensions	Minimum	Maximum
A	4.32	5.33
B	4.45	5.20
C	3.18	4.19
D	0.41	0.55
E	0.35	0.50
F	5°	
G	1.14	1.40
H		1.53
K	12.70	

Dimensions : Millimetres



Pin Configuration

1. Collector
2. Base
3. Emitter

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Absolute Maximum Ratings

Description	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Collector-Base Voltage	V_{CBO}	60	
Emitter-Base Voltage	V_{EBO}	6.0	
Collector Current Continuous	I_C	200	mA
Power Dissipation at $T_a = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/ $^\circ\text{C}$
Power Dissipation at $T_c = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5 12	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_j, T_{stg}	-55 to +150	$^\circ\text{C}$
Thermal Resistance			
Junction to Case	$R_{th(j-c)}$	83.3	$^\circ\text{C/W}$
Junction to Ambient	$R_{th(j-a)}$	200	

Electrical Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Description	Symbol	Test Condition	2N3904	Unit
Collector-Emitter Voltage	$*V_{CEO}$	$I_C = 10\text{mA}, I_B = 0$	>40	V
Collector-Base Voltage	V_{CBO}	$I_C = 10\mu\text{A}, I_E = 0$	>60	
Emitter-Base Voltage	V_{EBO}	$I_E = 10\mu\text{A}, I_C = 0$	>6.0	
Collector-Cutoff Current	I_{CEX}	$V_{CE} = 30\text{V}, V_{EB} = 3\text{V}$	<50	nA
Base Current	I_{BL}		<50	
DC Current Gain	$*h_{FE}$	$I_C = 0.1\text{mA}, V_{CE} = 1\text{V}$ $I_C = 1\text{mA}, V_{CE} = 1\text{V}$ $I_C = 10\text{mA}, V_{CE} = 1\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$ $I_C = 100\text{mA}, V_{CE} = 1\text{V}$	>40 >70 100 -300 >60 >30	-
Collector Emitter Saturation Voltage	$*V_{CE(sat)}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$ $I_C = 50\text{mA}, I_B = 5\text{mA}$	<0.20 <0.30	V
Base Emitter Saturation Voltage	$*V_{BE(sat)}$		0.65 - 0.85 <0.95	V

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Electrical Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Small Signal Characteristic

Description	Symbol	Test Condition	2N3904	Units
Transistors Frequency	f_T	$I_C = 10\text{mA}$, $V_{CE} = 20\text{V}$, $f = 100\text{MHz}$	>300	MHz
Output Capacitance	C_{ob}	$V_{CB} = 5\text{V}$, $I_E = 0$, $f = 1\text{MHz}$	<4.0	pF
Input Capacitance	C_{ib}	$V_{BE} = 0.5\text{V}$, $I_C = 0$, $f = 1\text{MHz}$ All $f = \text{kHz}$	<8.0	
Small Signal Current Gain	h_{fe}	$I_C = 1\text{mA}$, $V_{CE} = 10\text{V}$	100 - 400	-
Input Impedance	h_{ie}		1.0 - 10	k Ω
Output Admittance	h_{oe}		1.0 - 40	umhos
Voltage Feedback Ratio	h_{re}		0.5 - 0.8	$\times 10^{-4}$
Noise Figure	NF	$I_C = 100\mu\text{A}$, $V_{CE} = 5\text{V}$	<5.0	dB
Switching Time				
Delay Time	t_d	$V_{CC} = 3\text{V}$, $V_{BE} = 0.5\text{V}$	<35	ns
Rise Time	t_r	$I_C = 10\text{mA}$, $I_{B1} = 1\text{mA}$		
Storage time	t_s	$V_{CC} = 3\text{V}$, $I_C = 10\text{mA}$ $I_{B1} = I_{B2} = 1\text{mA}$	<200	
Fall Time	t_f	-	<50	

*Pulse Condition: = 300 μs , Duty Cycle = 2%

Specifications

V_{CEO} maximum (V)	I_C maximum (A)	$V_{CE(sat)}$ maximum (V) at $I_C = 10\text{mA}$	t_{off} maximum (ns) at $I_C = 10\text{mA}$	h_{FE} minimum at $I_C = 10\text{mA}$	P_{tot} at 25°C (mW)	Package and Pin Out	Part Number
40	0.2	0.2	250	100	500	TO-92	2N3904

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