

# 2N3904

## General Purpose Transistors NPN TO-92



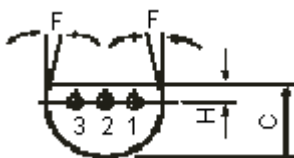
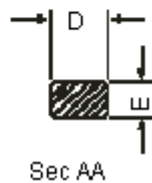
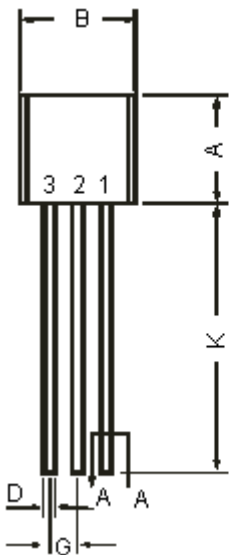
### High Speed Switching



### Features:

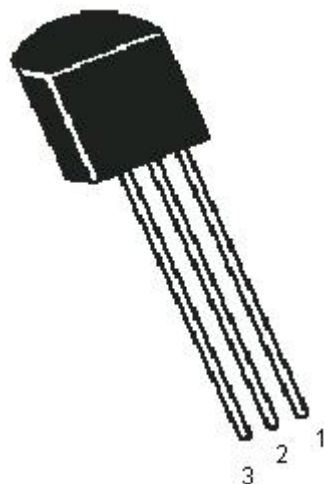
- NPN silicon planar switching transistors.
- Fast switching devices exhibiting short turn-off and low saturation voltage characteristics.
- General purpose switching and amplifier applications.

### 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 $25^\circ\text{C}$	$P_D$	625	mW
Power Dissipation at $T_c = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$		5.0	mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_j, T_{stg}$	-55 to +150	$^\circ\text{C}$
<b>Thermal Resistance</b>			
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-Cut off Current	$I_{CEX}$	$V_{CE} = 30\text{V}, V_{EB} = 3\text{V}$	<50	nA
Base Current	$I_{BL}$			
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	$*V_{CE(sat)}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$	<0.20 <0.30	V
Base Emitter Saturation Voltage	$*V_{BE(sat)}$	$I_C = 50\text{mA}, I_B = 5\text{mA}$	0.65 - 0.85 <0.95	V

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

Description	Symbol	Test Condition	2N3904	Units
<b>Small Signal Characteristic</b>				
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	$k\Omega$
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
<b>Switching Time</b>				
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 $\mu\text{s}$ , Duty Cycle = 2%

### Specifications

$V_{CE0}$ 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 $25^\circ\text{C}$ (mW)	Package and Pin Out	Part Number
40	0.2	0.2	250	100	500	TO-92	2N3904














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### Notes:

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