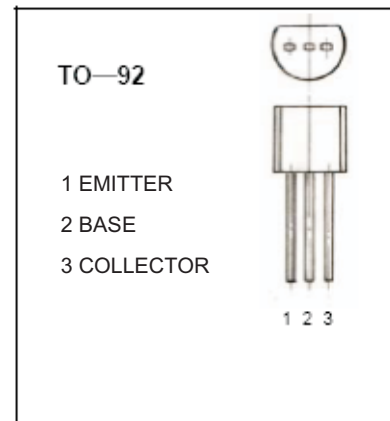


## NPN Transistors

### 2N3904

#### ■ Features

- NPN silicon epitaxial planar transistor for switching and Amplifier applications



#### ■ Absolute Maximum Ratings $T_a = 25^\circ\text{C}$

Parameter	Symbol	Rating	Unit
Collector - Base Voltage	$V_{CB0}$	60	V
Collector - Emitter Voltage	$V_{CE0}$	40	V
Emitter - Base Voltage	$V_{EB0}$	6	V
Collector Current - Continuous	$I_C$	0.2	A
Collector Power Dissipation	$P_C$	0.625	W
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to 150	$^\circ\text{C}$

#### ■ Electrical Characteristics $T_a = 25^\circ\text{C}$

Parameter	Symbol	Testconditions	Min	Typ	Max	Unit
Collector- base breakdown voltage	$V_{CB0}$	$I_C = 100 \mu\text{A}$ , $I_E = 0$	60			V
Collector- emitter breakdown voltage	$V_{CE0}$	$I_C = 1 \text{ mA}$ , $I_B = 0$	40			V
Emitter - base breakdown voltage	$V_{EB0}$	$I_E = 10 \mu\text{A}$ , $I_C = 0$	6			V
Collector cut-off current	$I_{CBO}$	$V_{CB} = 60 \text{ V}$ , $I_E = 0$			0.1	$\mu\text{A}$
Collector cut-off current	$I_{CEO}$	$V_{CE} = 40 \text{ V}$ , $I_B = 0$			0.1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 5 \text{ V}$ , $I_C = 0$			0.1	$\mu\text{A}$
DC current gain	$h_{FE}$	$V_{CE} = 1 \text{ V}$ , $I_C = 10 \text{ mA}$	100		300	
		$V_{CE} = 1 \text{ V}$ , $I_C = 50 \text{ mA}$	60			
		$V_{CE} = 1 \text{ V}$ , $I_C = 100 \text{ mA}$	30			
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 50 \text{ mA}$ , $I_B = 5 \text{ mA}$			0.3	V
Base - emitter saturation voltage	$V_{BE(sat)}$	$I_C = 50 \text{ mA}$ , $I_B = 5 \text{ mA}$			0.95	V
Delay time	$t_d$	$V_{CC} = 3.0 \text{ V}$ , $V_{BE} = -0.5 \text{ V}$			35	ns
Rise time	$t_r$	$I_C = 10 \text{ mA}$ , $I_{B1} = -I_{B2} = 1.0 \text{ mA}$			35	
Storage time	$t_s$	$V_{CC} = 3.0 \text{ V}$ , $I_C = 10 \text{ mA}$			200	ns
Fall time	$t_f$	$I_{B1} = -I_{B2} = 1.0 \text{ mA}$			50	
Transition frequency	$f_T$	$V_{CE} = 20 \text{ V}$ , $I_C = 10 \text{ mA}$ , $f = 100 \text{ MHz}$	300			MHz