

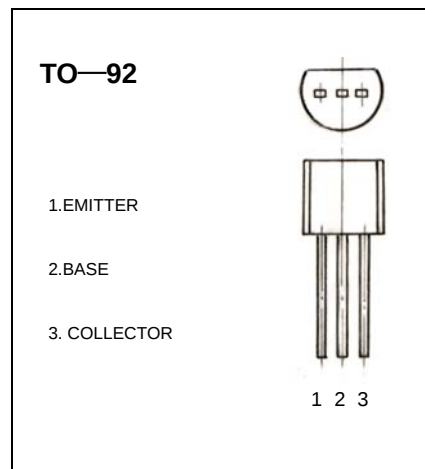


TO-92 Plastic-Encapsulate Transistors

2N3904 TRANSISTOR (NPN)

FEATURE

- NPN silicon epitaxial planar transistor for switching and Amplifier applications
- As complementary type, the PNP transistor 2N3906 is Recommended
- This transistor is also available in the SOT-23 case with the type designation MMBT3904LT1



MAXIMUM RATINGS* $T_A=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	40	V
V_{EBO}	Emitter-Base Voltage	6	V
I_C	Collector Current -Continuous	0.2	A
P_C	Collector Dissipation	0.625	W
T_J, T_{stg}	Junction and Storage Temperature	-55-150	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS ($T_{amb}=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Collector-base breakdown voltage	$V(BR)_{CBO}$	$I_C=10\mu\text{A}$, $I_E=0$	60			V
Collector-emitter breakdown voltage	$V(BR)_{CEO}$	$I_C=1\text{mA}$, $I_B=0$	40			V
Emitter-base breakdown voltage	$V(BR)_{EBO}$	$I_E=10\mu\text{A}$, $I_C=0$	6			V
Collector cut-off current	I_{CBO}	$V_{CB}=60\text{V}$, $I_E=0$			0.1	μA
Collector cut-off current	I_{CEO}	$V_{CE}=40\text{V}$, $I_B=0$			0.1	μA
Emitter cut-off current	I_{EBO}	$V_{EB}=5\text{V}$, $I_C=0$			0.1	μA
DC current gain	$h_{FE(1)}$	$V_{CE}=1\text{V}$, $I_C=0.1\text{mA}$	40			
	$h_{FE(2)}$	$V_{CE}=1\text{V}$, $I_C=1\text{mA}$	70			
	$h_{FE(3)}$	$V_{CE}=1\text{V}$, $I_C=10\text{mA}$	100		400	
	$h_{FE(4)}$	$V_{CE}=1\text{V}$, $I_C=50\text{mA}$	60			
	$h_{FE(5)}$	$V_{CE}=1\text{V}$, $I_C=100\text{mA}$	30			
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C=10\text{mA}$, $I_B=1\text{mA}$			0.2	V
		$I_C=50\text{mA}$, $I_B=5\text{mA}$			0.3	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C=10\text{mA}$, $I_B=1\text{mA}$			0.85	V
		$I_C=50\text{mA}$, $I_B=5\text{mA}$	0.65		0.95	V
Output capacitance	C_{obo}	$V_{CB}=5\text{V}$, $I_E=0$, $f=100\text{KHz}$			4	pF
Input Capacitance	C_{ibo}	$V_{EB}=0.5\text{V}$, $I_E=0$, $f=100\text{KHz}$			8	pF
Noise figure	NF	$V_{CE}=5\text{V}$, $I_C=100\mu\text{A}$, $f=1\text{KHz}$, $R_S=1\text{K}\Omega$			5	dB
Transition frequency	f_T	$V_{CE}=20\text{V}$, $I_C=10\text{mA}$, $f=100\text{MHz}$	300			MHz

Delay Time	td	V _{CC} =3V, V _{BE} =0.5V, I _C =10mA, I _{B1} =1mA			35	ns
Rise Time	tr				35	ns
Storage Time	ts	V _{CC} =3V, I _C =10mA I _{B1} =I _{B2} =1mA			200	ns
Fall Time	tf				50	ns

CLASSIFICATION OF h_{FE(3)}

Rank	O	Y	G
Range	100-200	200-300	300-400

Typical Characteristics

2N3904

